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VIEWS, NEWS AND INTERVIEWS.

Near White Hills, Colo., will be situated a novel electric plant. It is expected that two barges will be anchored in the Colorado river, and on them will be placed an immense water wheel to be driven by the strong current. By an ingenious system of flexible gearing the power will be communicated to a number of generators placed on the bank, and the current will be transmitted to White Hills, where it will be used as a motive power in the mines and mills of the place.

It is expected that a new high speed electric boat will be exhibited at the annual Fourth of July regatta on the Schuylkill river, at Philadelphia, this year. The Cup and People's Regatta Committee for 1893 has organized, with Dr. Conrad Berens as chairman, and his proposition is to rig up an eight-oared shell with a propeller to be driven by electricity. The weight of an eight-oared crew and fixtures is about 1,000 pounds, and the electric apparatus and gearing can even exceed that weight a little, since it will be mostly below, instead, as with a crew, mostly all above the washboard. The American Electro Dynamo Company, of Philadelphia, has secured the contract to make the experiment on an Undine Club eight-oared shell, and the work will be pushed forward at once. The body of the shell will be used entirely for the storage cells and motor, and the one occupant of the boat, who will sit in the coxswain's seat, will be captain, engineer, helmsman and referee of the race. The propeller will be fitted under the shell and will probably be located just back of the coxswain's seat. It is believed that such a craft will be capable of even greater speed than the Yankee Doodle showed, and will, in addition, be free from all objectionable features which larger boats have on a rowing race course. There will be practically no suction influence such as large boats have over racing shells, and the referee can actually mix with the contesting crews, should occasion require, without interfering with them.

A plea for a universal telegraphic hour is made by the *Journal Télégraphique*, the proposition being to count the hours one to 24 for telegraphic purposes from a fixed meridian. We in America read of events that have happened in Australia a day after the date the news is received here, because the telegraph can beat the sun by almost a whole day. A universal telegraphic time would obviate this anomaly.

Between London and Paris the long distance telephone lines have almost supplanted the telegraph, so much more expeditious are they. For example, the average time for transit of a telegram between Paris and London, reckoning the time for checking, transmission, copying and delivery, is about 30 minutes. The telephone affords instantaneous communication, so that fully five per cent. of all business done between the stock exchanges of the two cities is done over the long distance line.

John Camp is on trial in the criminal court of St. Louis, charged with grand larceny for stealing electricity from the Missouri Electric Light and Power Company.

It is now estimated that the Westinghouse Electric Company's net income for the year ending with this month will be upwards of $1,000,000 after the preferred stock dividend is paid.

All the telegraph, telephone and electric light wires in the business portion of Pittsburgh, Pa., will be underground by January 1, 1896. The big improvement will cost $12,000,000. Last fall councils passed an ordinance which provides that beginning with this year, 25 per cent. of the wires shall be put underground until they have all disappeared. The work will require four years in its accomplishment. In two weeks the process will begin.

The General Electric Company has just started from the Schenectady works the field frames for the 1,500 horse-power combined engine and dynamos on two separate cars of 38,000 pounds each. The engine for this enormous machine is about ready to start from the works. It will require for its shipment about eight of the heaviest cars made, and will come with a special locomotive messenger in an unbroken train.

The report has been going the rounds that there is in existence a new apparatus for the measurement of actinism which promises to be of great service to astronomers, as it will be specially valuable in examining the luminosity of the sky in diffused light. The apparatus presents some interesting features from an electrical point of view. Its action is stated to be as follows, and the apparatus consists essentially of two plates of oxidized copper immersed in water containing a certain percentage of either chloride, iodide or bromide of sodium. One of the plates is exposed to the action of the rays of light, while the other is protected from this action, either by surrounding it with parchment or paper, or by placing it directly behind the first plate at a distance of about a millimetre. The action of the light is instantaneous, and although the sensitiveness of the element decreases rapidly at first, it soon becomes virtually constant. It will thus be seen that the electromotive force of the apparatus is the phenomenon upon which the determinations depend; this varies with the color of the light which acts upon it.

The trial is reported of a new electrical submarine boat, which is said to be favorably regarded by the Italian government. She is 28 feet long and eight feet wide, and has the peculiar depth of 11 feet, the total weight being 40 tons. The special advantage claimed for this boat over all others of its kind is that it can remain under water, if need be, for the space of 48 hours, besides being able to descend to a depth of 130 feet.

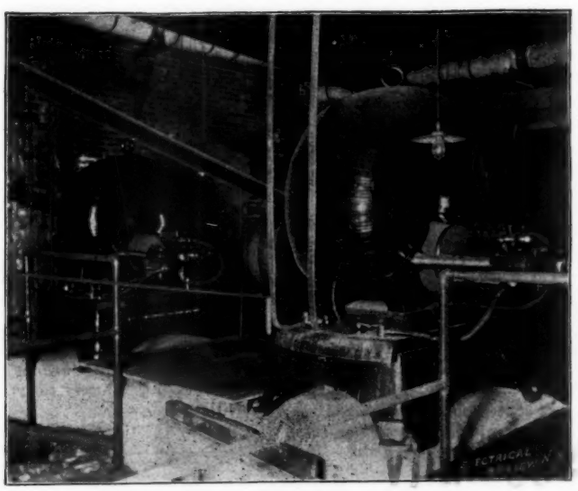


FIG. 1.—MATHER GENERATORS IN THE "YOUTH'S COMPANION" BUILDING, BOSTON.

A Fine Isolated Lighting Plant.

MATHER GENERATORS IN THE "YOUTH'S COMPANION" BUILDING, BOSTON.

The magnificent structure erected and occupied by the *Youth's Companion* is undoubtedly the finest business building in the city of Boston. Its appointments throughout are first-class, and the electric lighting plant is worthy of special mention.

As an isolated plant it is unsurpassed by anything in this section, and Messrs. Claflin & Kimball, to whom the entire work was intrusted, have fully maintained their reputation in the results here shown.

The engine and dynamo room is located in the basement, and completely fills a space 36x64 feet. Current is supplied by two Mather dynamos, one being of 1,000 and the other of 600 light capacity, connected in multiple.

These are driven by two single expansion Harris-Corliss engines of 125 horse-power each. The driving wheels of these engines are 19 feet in diameter with a 26 inch face, and are fitted with idlers and belt tighteners, which do away with friction clutches and allow the engines to be run separately or together, as desired. The dynamos are also supplied with the same device, making the entire system interchangeable. No wires are anywhere visible in the building, the current being carried from the dynamos to the switchboard by a Clark cable laid under the floor, and from there throughout the building through interior conduits.

The switchboard is a very noticeable feature. It is of white marble, 5x8 feet, and contains every necessary appliance. At the top are a clock, thermometer, and steam gauge, and below these two ammeters and a voltmeter. Next comes four double-throw three wire switches, and below these are two rheostats, two main dynamo switches, and one voltmeter switch connected for both machines and also used as a ground detector.

The building is wired in four separate and distinct sections, each section having its own switch and connecting by a flexible system with the Edison street service. Current can thus be drawn either from their own plant, from the street system or from both together if desired. At night the machinery can be entirely shut down and yet have lights in any section of the building where extra work is necessary.

Two thousand incandescent lights are used at the present time, though it is seldom they are all called into service at once, but when they are, they are ready for use and the current is there to supply them.

The shafting, pulleys and friction clutches were supplied by The Stilwell-Bierce and Smith-Vaile Company, of Dayton, Ohio. Their installation called for special engineering skill, because everything had to be supported on iron columns, and because the owners of the building refused to allow

hangers, boxes or shafting supports to be attached to the ceiling. The friction pulleys are made under Rice's patent and have given very satisfactory service.

Referring to Figs. 3 and 4, *A A* are friction pulleys 48 inches in diameter with 26 inch face, each transmitting 125 horse power from the engine. *B* is a friction coupling. *C C* are friction pulleys, 66x13 inches, for the dynamos. *D* is a friction pulley 60x20 inches, located on the main line and cutting off all the power from the press room. *E* is a friction pulley 36x12 inches, driving a side line for miscellaneous purposes.

The Electric Plant in the Havemeyer Building.

The electric lighting plant of the Havemeyer building in this city, which has recently gone into operation, deserves more than ordinary attention, as it contains all the most recent developments in incandescent electric lighting for isolated plants. The plant is one of 3,000 lights. There are four McIntosh & Seymour engines and four Eickemeyer dynamos. Three of the engines are of 65 horse-power, and directly coupled upon the shaft of each of these engines is a dynamo of 40 kilowatts. The fourth engine is 20 horse-power, and an entirely new and very interesting rope drive connects the engine to a dynamo of 12 kilowatts. This small engine and dynamo is for use during periods of light load.

The switchboard is of polished, jet black, marbleized slate, and mounted on this are the voltmeters, amperemeters, main line switches, rheostats, ground detector and multiple switch for reading the electromotive force at various points in the building. The rheostats are those of the Carpenter Enamel Rheostat Company, and they present a very handsome appearance, and occupy a surprisingly small space. The voltmeters and amperemeters are those of the Weston Company, and are of their central station type with illuminated dials, and were made especially for use in this particular plant.

There are two voltmeters and five amperemeters, one amperemeter being in the circuit of each dynamo, and one reading the entire output of the plant. There are 14 Ajax switches upon the switchboard, one for connecting the entire building upon the mains of the three wire central station of the Edison Company; one for each dynamo; eight for the office lights of the various floors, and one for the hall lights.

The wiring of the building is done with metal covered interior conduit throughout. Edison cut-outs and incandescent lamps were used.

The entire plant was installed by H. Ward Leonard & Company, of New York, under the supervision of Mr. Frank A. Pattison, the consulting electrical engineer of the architect, George B. Post. Promptly upon completion the entire plant was subjected to an exhaustive test by Mr. Pattison, lasting two days. The dynamos were subjected to a full load test of 10 hours, and operated very perfectly in every way. The rise in temperature was 100 degrees Fahrenheit at the end of the 10 hours run. Indicator diagrams from the various engines showed a very perfect steam distribution and very close governing. The insulation of the system of conductors was extremely high, being 160,000 ohms with every thing in circuit. The plant was immediately passed by the fire underwriters and accepted by the owners.

This plant is the first of its type in this country; that is, one in which bipolar dynamos are operated by being directly connected to standard engines running at 275 revolutions per minute. The extremely small space occupied by the plant and the entire freedom from all noise and vibration leave no room for doubt that plants of this nature will soon become almost universal for buildings of this description. It is a matter of interest to note that the floor space occupied by the entire plant, including the space between the dynamos and surrounding them, is only five square feet per kilowatt.

Important German Patents.

Dr. Phil. H. Zerener, of Berlin, has sent us the following list of important German patents issued from March 6 to March 9, 1893, by the Imperial German Patent Office:

GALVANIC ELEMENTS AND ACCUMULATORS.

21 K. 9785. Galvanic element constructed like Zamboni pile. Dr. Hugo Köller, Wien I.

21 S. 7023. Preparing electrodes for accumulators similar to proceeding of Planté. Süddeutsche Electricitäts-Gesellschaft, Raab & Bastians Kommandit-Ges., München.

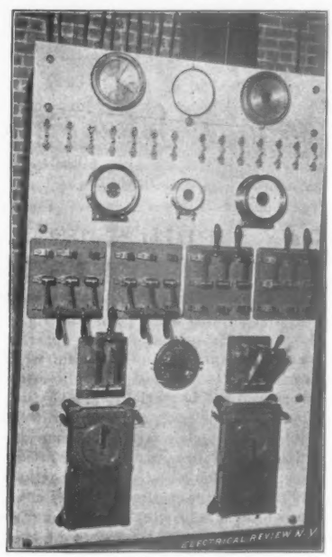


FIG. 2.—SWITCHBOARD IN "YOUTH'S COMPANION" BUILDING, BOSTON.

21 K. 9844. Electrode plate for accumulators. Dr. O. Knöpfler and Fr. Gebauer, Charlottenburg.

ELECTRO-MOTORS.

21 L. 7775. Contrivance signalizing synchronous motion of the electro-motors with reversed currents and a synchronous working. W. Lahmeyer & Company, Frankfurt a/M.

INSULATORS.

21 Sch. 8558. Insulator for electric conducting wires with contrivance for fixing conductors without binding wire. Rud. Schomburg, Berlin W.

ELECTRIC LAMPS.

21 B. 13674. Incandescent lamp with several coal fibres. Otto Berndt, Rostock.

21 F. 6359. Small electric incandescent lamp. Franz Feldhaus, Köln a/Rh.

MISCELLANEOUS.

36 S. 6259. Electric heating apparatus. H. von Samson-Himmelstjerna, Freuburg i/Br.

74 A. 3352. Electric bell. Actien-Gesellschaft, Mix & Genest, Berlin.

Elgin Electric Club.

The Elgin, Ill., Electric Club now has a membership of about 60 and its meetings, held every Saturday evening, are well attended. The officers of the club are Frederick Purdy, president; Dr. G. L. Marion, vice-president; J. Frank North, secretary; Henry Klinder, treasurer; and R. W. Pikerton, librarian.

The Edison Feeder Patent.

THIS IMPORTANT CASE, WHICH HAS BEEN DECIDED IN FAVOR OF EDISON, DISCUSSED FROM OPPOSITE POINTS OF VIEW—WHAT IT INVOLVES.

The decision in the Edison Feeder patent, in favor of the complainants, the Edison Electric Light Company, is one which seems to be looked upon in a satisfactory light by both parties to the suit.

Judge Green, of the United States Circuit Court for the District of New Jersey, sitting in Trenton, handed down a decision, on March 28, in the case of the Edison Electric Light Company *vs.* Westinghouse, Church, Kerr & Company.

This decision, which was the result of a prolonged and expensive litigation, may be at present considered but the partial outcome of one of the suits for infringement.

The patent of Mr. Edison which is involved in this suit, and dated September 19, 1882, is familiarly known as the "Feeder and Main Patent." After Mr. Edison had invented his carbon filament lamp, the practical distribution of the lights being brought to a satisfactory termination, it followed that the distribution of the current without undue loss was the problem which had to be solved before the installation of electric lights in public buildings could be an assured success. To this end he invented and patented a means whereby this could be successfully accomplished. The drop in electromotive force at the end of a line which furnished current for a number of lamps arranged in multiple arc was considerable where the main wire was uniform in thickness throughout. In the "tree" system large masses of copper were required in order to successfully furnish current for the lamps arranged in multiple arc, and so great was the cost of this mass of copper as to render the installation of a plant on a large scale prohibitory. By the feed wire system, which supplies current to sections of the line, thus entailing a very small per centage of drop, large plants could be installed at a comparatively moderate expense.

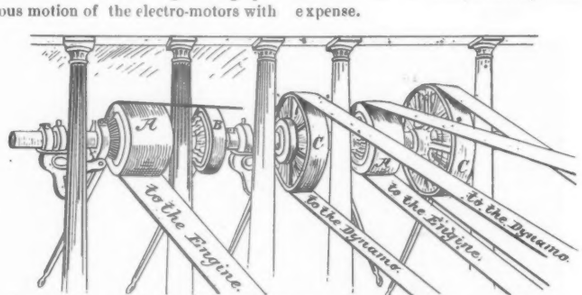


FIG. 3.—SHAFTING AND FRICTION CLUTCHES IN "YOUTH'S COMPANION" BUILDING, BOSTON.

In this suit numerous models and devices for practical illustration, exhibited in the court room at Trenton, showed the immense saving of copper in a very comprehensive manner.

This case, which has involved the validity of this patent, has been strenuously protected by the Westinghouse Company. The most extensive testimony was procured, that of Sir William Thomson alone covering 145 pages.

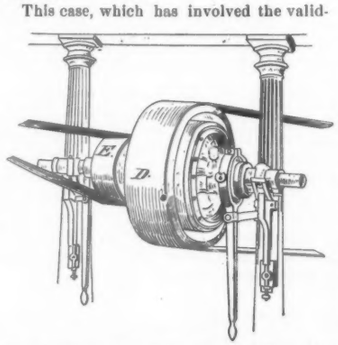


FIG. 4.—FRICTION PULLEY IN "YOUTH'S COMPANION" BUILDING, BOSTON.

It will, perhaps, be interesting to the general public to know how this matter is looked at by both parties. In the brief submitted by Frederic H. Betts, counsel for the Edison people, he concludes as follows:

"We submit, then, that the 'Feeder and Main' invention of Edison was one involving 'invention' of a high class, was not anticipated by any constructor, nor found described by any prior patent or publication; that it is clearly infringed as to the first three claims thereof; and that the complainant is entitled to a decree."

The following is the conclusion of the brief of the counsel (Messrs. Kerr, Curtis and others) for the Westinghouse Company:

"The evidence on this issue is very conflicting, and not only has complainant failed to sustain the burden of proof, but the preponderance of evidence shows a construction of the circuits of defendant's plant which would, upon any admissible interpretation of the claims, not be covered by them. It is respectfully submitted that the bill should be dismissed with costs."

The Edison people regarded this invention as an intellectual conception, and believed that the result would be such as to bring many millions of dollars into their treasury, while, on the other hand, the Westinghouse people seemed not to be at all affected by the decision, and declared that the amount of money involved was very small indeed.

The following report has been circulated and the wording is especially worthy of notice:

"In the decision given by Judge Green, said to have been favorable to the General Electric Company, it is claimed by the Westinghouse people that it applies to a system abandoned by that company four or five years ago, and does not affect its present system, nor does it in any way affect its railway system. In any event, the patent has only about a year to run, being limited by an English patent taken up in September, 1880, for 14 years."

Mr. George Westinghouse declared that this report sums up the matter in a very few words, and, moreover, that the company does not use any system which would conflict with or infringe on the system described in the patent, and, furthermore, that the amount of money involved could not be estimated, as several of the reports have put it, in the millions of dollars, nor could it even be calculated in cents.

From this it would seem that the decision has not hurt the Westinghouse interests to any considerable extent, and that they are unconcerned regarding its outcome.

The Edison people claim that the amount of money involved is considerable, and that, moreover, if the decision is appealed, as they expect it will be, and confirmed, the Edison people will have a complete monopoly of all central station distribution.

This is a remarkable difference of opinion.

If the appeal is sustained, the patent, the Edison attorneys state, will have to run until September 19, 1899, and the amount of money brought into the treasury of the Edison Company would, they imagine, be so considerable that the monopoly would far exceed that of the Standard Oil Company in point of value.

Winners in the Telegraphers' Tournament.

The final decisions in the telegraphers' tournament, held in Hardman Hall, on March 25, are as follows:

First Event—Ladies' class; 500 words. First prize, $25, Mrs. C. L. White; second prize, $15, Mrs. S. E. Sandberg.

Second Event—Message class. First prize, gold medal valued at $150, B. S. Durkee; second prize, gold medal valued at $100, J. F. Parks.

Third Event—Open to all except those who had sent more than 235 words in five minutes in a previous tournament. First prize, $100, C. L. Hayes; second prize, $75, H. B. Logan.

Fourth Event—Open to all who had not sent more than 230 words in five minutes in a previous tournament. First prize, $100, E. H. Curlette; second prize, $75, J. H. Jones.

Fifth Event—Code Class. First prize, $100, C. L. Hayes; second prize, $75, H. B. Logan.

Sixth Event—Championship Class. First prize, $100 and championship medal, H. B. Logan; second prize, $75, J. M. Winder.

Francois Van Rysselberghe.

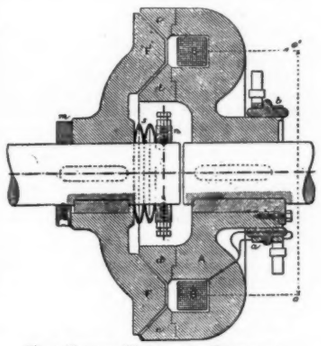
Francois Van Rysselberghe was born in Gand, August 24, 1846. He died at the early age of 47 in the city of Anvers after a short sickness early in February, 1893. As is well known, nearly all his life had been consecrated to the study and advancement of applied electricity, and his achievements in this branch of modern industry entitle him to be classed among the foremost electricians of Europe. Van Rysselberghe—to use a favorite American expression—was a self-made man; he owed his fame to his personal work, to his untiring energy. By his father, a common day laborer, Van Rysselberghe was instructed in the rudiments of knowledge, but while his first teacher may not have endowed his pupil with much valuable knowledge, he bestowed upon his son the traits of his own character—indomitable will power, unbending energy and ardent love for work. As a young boy, Van Rysselberghe attended the College Sainte-Barbe, from which school he was graduated with honor in 1863, at the age of 17. How well he employed his college years is evident from the fact that upon leaving Sainte-Barbe he was offered the position of tutor at the Athenaeum of Tournay. His stay at the latter city lasted but a few months. He left Tournay to accept a professorship at Gand. Shortly after his arrival at Gand, the mathematical chair of the Ostende School of Navigation became vacant, and the faculty invited applicants for that high position to forward some theses or essays by which their intellectual fitness for the professorship might be determined. Suffice it to state that Van Rysselberghe carried off the palm in 1865.

Having gained at last a highly prized position, which secured him against financial difficulties, he devoted himself to his favorite occupation—invention. Living, as he did, near the shore of the ocean, it is natural that he first turned his attention to meteorology, and in a comparatively short time he evolved two wonderful pieces of fine apparatus—the météorographe and the télémétéorographe. In each of these now much used devices electricity is employed as the motive power. Without entering into a detail description of the invention, it may be stated that at the Paris Electrical Exposition, in 1881, the télémétéorographe placed at the Hall of Industries accurately registered at Taros the meteorological conditions prevailing at Bruxelles, a distance of 240 kilometers. However, the invention upon which rests his claim for universal admiration was yet to be evolved. This is the simultaneous transmission of telephony and telegraphy. Although telegraphic and telephonic electrical impulses widely differ in form and character, Van Rysselberghe found means to overcome this apparently unconquerable inequality. As his invention is well known to every modern electrician, we merely add that practical simultaneous telegraphy and telephony is impossible without the use of the system of graduated currents invented by Van Rysselberghe. His next great achievement was the phonomultiplex—that is to say, he devised means by which nine persons may exchange intelligence with nine other people over a single conductor, without any interference whatsoever. Shortly before his death the inventor proved the practicality of his invention by an actual commercial test made over a line of 300 kilometers, or 79 miles. It seems that little is known of this invention in the United States, and yet the time is not far in the future when the telephone as well as telegraph electrician may be obliged to use Van Rysselberghe's invention.

Besides simultaneous telephony and telegraphy, Van Rysselberghe occupied himself with the construction of long distance lines, solving many important problems. Personally he was what the French call a "charmeur," a man of great personal magnetism, and, as a matter of course, he had a large number of friends and acquaintances. In 1875 the French Government awarded to Van Rysselberghe the first prize for his météorographe, and in 1881 the same government enrolled him among the knights of the Legion of Honor. Van Rysselberghe's invention, simultaneous telephony and telegraphy, to day is used on every telegraph line in Belgium.

The Bovet Magnetic Coupling.

The Bovet magnetic coupling, recently described in *L'Industrie Electrique*, is attracting considerable attention in the mechanical world. The coupling, which is shown in the accompanying illustration, consists of a block *A* in cast or wrought iron, around the face of which a groove is made, in which the wire *B* is placed. It terminates in rings *A B*, on which brushes bear. The whole is keyed to the power shaft. The shaft to be clutched is provided with a block *F*, capable



THE BOVET MAGNETIC COUPLING.

of sliding along and approaching *C D* until it is in contact. It follows, therefore, that when the wire *B* is traversed by a current, *F* is attracted against *C D*, and participates in the motion of *A*. The chief advantage of the system resides in the fact that, contrary to that which takes place with all kinds of friction clutches, adhesion is obtained without any external reaction. The magnetic forces in a closed circuit are all internal, and there is no thrust on the journals nor reaction of elastic parts on supports. It will be observed that the magnetic circuit is cut across in the shape of a wedge. This is another very important point, which gives the apparatus the valuable property of limiting the maximum transmitted effort, and permitting slipping when this amount is exceeded. Experiment shows that if the resisting effort becomes too great *A* slips, but does not release *F*. This property enables one to entirely avoid injury to apparatus connected to *F*, such as chains, gearing, etc., since it is only necessary to regulate the value of the current in order to insure that the required maximum effort is not exceeded. If the contact surfaces of *A* and *F* were flat, the same result would not be attained; there would no longer be merely slipping, but complete disconnection, which might often give rise to grave inconveniences. With very small dimensions this clutch can be used for very large powers. A 400 or 500 horse-power clutch running at an average speed is only from 36 to 40 inches in diameter.

The Buckeye Lamp Factory is Closed.

The Buckeye Electric Company, of Cleveland, O., manufacturers of the well known Buckeye incandescent lamp, shut down their factory on March 25. Mr. F. H. Prentiss, the president of the company, was seen at his New York office in the *Mail and Express* building, and in the course of an interview said:

"We have decided, for the present, to stop the manufacture, sale and shipment of incandescent lamps, and have therefore closed our plant at Cleveland. We shall also give up our New York office on May 1. We do this voluntarily, as no legal proceedings have been taken against us. Further than this I do not care to say anything."

Treasurer Rockwell, of the Buckeye Electric Company, told a representative of the ELECTRICAL REVIEW several weeks ago that his company had made a lamp very similar to the Westinghouse stopper lamp which had undergone satisfactory tests. It is possible that the Buckeye Company is preparing to bring out this lamp or another new one, and it may be that they have ceased operations pending the completion of negotiations with the General Electric Company by which they may continue to make lamps. While none of these surmises can be confirmed, it is believed that the Buckeye Electric Company has not gone out of business, and may eventually become a very important factor in the manufacture of incandescent lamps.

So far as is known none of the Ohio lamp manufacturers has as yet been enjoined by the General Electric Company.

A New Alternating Current Fan Motor.

The Holtzer-Cabot Electric Company, 92 Franklin street, Boston, Mass., have ready for delivery during the coming hot season an alternating current fan motor which seems destined to have a large sale. It has considerable power, runs about 1,600 revolutions per minute, and does not get hot after being in use for some hours.

A specially desirable feature is the arrangement of the brushes and commutators, which are usually the most troublesome points in fan motors of all descriptions. The brushes are carbon and self-feeding, the commutators being inside, out of the way of dust, interference, etc. It is designed to work either on 52 or 104 volt currents.

HOLTZER-CABOT ALTERNATING CURRENT FAN MOTOR.

A Valuable Catalogue.

The Chapman Valve Manufacturing Company, of Indian Orchard, Mass., has just issued to engineers and their patrons another edition of their valuable catalogue. It is handsomely bound in cloth with a flap cover, and includes complete information regarding gate valves and fire hydrants, besides an engineering appendix. The electrical notes by Hollon C. Spaulding, S. B., E. E., should prove especially valuable to patrons of the Chapman Valve Manufacturing Company.

FINANCIAL.

The Norwich, N. Y., Electric Light Company was recently sold on foreclosure for $15,000 to a Troy man.

The Edison Electric Light Company, of Philadelphia, recently declared a quarterly dividend of two per cent., payable March 31.

The Massachusetts Supreme Court has decided that a foreign corporation doing business in the State is not liable for taxes on its personal property.

The annual meeting of the Mexican Telephone Company will be held in New York, April 19. Transfer books closed March 20 and will reopen April 20.

The Edison Electric Illuminating Company, of New York, has declared a regular quarterly dividend of 1½ per cent., an increase of one quarter per cent.

The Washburn & Moen Manufacturing Company, of Worcester, Mass., has increased its capital stock from $2,500,000 to $3,000,000, in order to enlarge the new plant at Waukegan, Ill.

At a recent special meeting of stockholders of the Edison Electric Illuminating Company, of New York, it was voted to issue $3,050,000 stock to take up $3,025,000 convertible bonds.

The annual meeting of the Thomson-Houston Electric Company will be held at Middletown, Conn., April 10. Common and preferred transfer books closed March 31 and will reopen April 11.

The controlling interests in the Ottawa, Ont., Gas Company and the Ottawa Electric (arc) Light Company have been sold for $500,000 to an English syndicate, with headquarters at Montreal. The syndicate, it is said, aims to control all the gas and electric light companies in Canada.

The Electric Corporation, of Boston, has profitably invested about $300,000 of its first $1,000,000 paid in upon capital account. It is claimed that the Electric Corporation is not formed to buy either West End or General Electric stocks or any assets of the General Electric Company. Its business is banking electric concerns upon its own account and for its own profit.

The annual report of the General Electric Company will cover the earnings for only eight months, but will include the dividends for nine months. The *Boston News Bureau* understands that it will show $1,000,000 surplus for this period, above three quarterly dividends, and after charging off $1,500,000, according to the conservative system of the old Thomson-Houston Company.

The annual meeting of the Commercial Cable Company was held at 1 Broadway on March 20. The old board of directors were unanimously re-elected. In order to provide for the laying of a third cable, it was decided to offer to the shareholders, for subscription at par, 19,290 shares out of 22,840 shares now unissued. Each shareholder will be entitled to subscribe for one share for every four shares held.

Another increase in the capital stock of the Toledo Electric Company is to be made. In August, the capital was raised from $200,000 to $400,000, and now it is to go up to $500,000. Recently the directors called a session for Tuesday morning, April 18, when all the stockholders will be present. The total securities of the company will be $1,000,000, as $500,000 of bonds are to be issued. The capital is raised so that the facilities for electric lighting may be increased.

There is no foundation for the rumor that the price of incandescent lamps is to be materially raised. As a matter of fact the General Electric Company is selling its lamps for less than when it received its recent decision sustaining the Edison patent and giving it the monopoly of the incandescent lamp business, and it is not to advance prices just because the company has a monopoly. Increased business and electrical development is the policy of the General Electric, and lower prices stimulate business. The history of electrical development is the history of price reductions. Electric car equipments are now selling for one-third the former cash price for half the present efficiency.—*Boston News Bureau.*

American Bell Telephone Company.

ANNUAL MEETING OF STOCKHOLDERS—THE YEARLY REPORT—PRESIDENT HUDSON RE-ELECTED—COMMENTS ON EXPIRING PATENTS — CAPITAL INCREASED TO $20,000,000.

President John E. Hudson presided at the annual meeting of the American Bell Telephone Company held March 28 at the company's building, No. 125 Milk street, Boston.

Every seat in the large room was occupied, while many of the stockholders were obliged to stand.

The report of the directors for the year ending December 31, 1892, was submitted by the president of the company, Mr. John E. Hudson.

The report begins with the statement that the year 1892 was marked by a considerable increase of business, and that the extension and improvement of the plants of the companies operating under the company's licenses, as well as of the improvement of the service, have been most satisfactory.

The instrument record shows that on December 20, 1892, 552,720 telephones were in the hands of licensees under rental, an increase of 40,313 over the same date in the previous year.

From the table of exchange statistics it is learned that the total number of exchanges was, on January 1, 1893, 812, a gain of 24; that the number of branch offices was 539, a gain of 30; the wire mileage on poles 201,259, a gain of 21,120; the wire mileage on buildings 14,980, a gain of 26; the mileage of wire underground 90,216, a gain of 19,882; the mileage of submarine wire 1,336, a gain of 307; and the total wire mileage was 307,791, a gain of 41,335. It appears that the total number of employés increased 1,594 during the year, bringing the total up to 9,970, and that the whole number of exchange stations, which is practically synonymous with subscribers, was, on January 1, 1893, 232,140, a gain of 16,123 during the year.

The estimated number of exchange connections, ascertained largely by actual count, is 1,868,189, or about 600,000,000 per annum.

The number of daily calls per subscriber varies in different exchanges from two to 17, the average throughout the United States being 8⅗, showing an increase from last year in the average use made of the telephone by each subscriber of 10 per cent.

The average cost to the subscriber varies from less than two to 11 cents per connection, according to the size of the exchange and the character of the service.

The wire mileage of extra territorial lines, which are lines connecting exchanges, on January 1, 1893, was 133,002, an increase for the year of 17,914.

The average number of toll connections per day is reported at 40,772, or about 13,000,000 yearly, and the total toll revenue was $1,897,258.33. To this is to be added $643,436.77, the gross earnings of the American Telephone and Telegraph Company, commonly called the Long Distance Company.

The earnings of this company in 1892, as given above, $643,436.77, exceed those of the previous year by about 50 per cent.

The detailed statement of underground construction shows that it exists in 33 cities in the country, and that Boston stands third in the mileage of telephone wire underground, being exceeded in this respect only by New York and Chicago.

LEDGER BALANCES.

FINANCES.

The ledger balances for December 31, 1892, are given as follows:

DEBTORS.

Telephones	$1,133,900 39
Real Estate	950,976 61
Stocks	34,120,795 56
Merchandise and machinery	14,440 73
Bills and accounts receivable	3,781,747 52
Cash and deposits	2,365,419 10
Total	$42,367,279 91

CREDITORS.

Capital stock	$17,500,000 00
Debenture bonds, 1888	2,000,000 00
Bills and accounts payable*	1,334,515 76
Patent account (profit and loss)	10,169,924 75
Profit and loss	5,684,104 97
Reserve	3,357,722 82
Surplus	2,151,011 61
Total	$42,367,279 91

* Of this amount $1,050,000 was for dividends payable January 15, 1893.

EARNINGS AND EXPENSES.

The detailed statement of earnings and expenses is as follows:

EARNINGS, 1892.

Rental of telephones	$3,303,753 10
Dividends	1,422,047 93
Commission on ex-telegraphic lines	101,306 32
Commission on telegraphic business	29,417 31
Real Estate	67,868 14
Interest	168,830 22
Miscellaneous	7,663 57
Gross earnings	$5,100,886 59

EXPENSES, 1892.

Expenses of operation	$878,272 89
Legal expenses	87,767 28
Real Estate	35,666 19
Interest and taxes	279,638 93
Commission	648,689 25
Royalty	10,000 00
Concessions	246,914 53
Miscellaneous	2,262 74
Expenses	$1,689,211 81
Leaving net earnings of	$3,411,674 78
Adding surplus, January 1, 1892	2,151,011 61
Total	$5,562,686 39

This amount was appropriated as follows:

Regular dividends, 1892	$1,927,227 00
Extra dividends, 1892	991,863 00
Reserve, general depreciation	400,000 00
Reserve, depreciation of instruments	92,584 78
Surplus accounts, December 31, 1893	2,151,011 61
Total	$5,562,686 39

Attention is called to the fact that only one of the past eight years shows so large an increase in the number of exchange stations reported by the operating companies. The report continues:

And not only has there been a large increase of subscribers, but an interesting feature of the statistics, of which mention has been made in earlier reports, is the increase of the daily use, by each subscriber, of the local exchange service.

In 1892 the average of use was greater by 10 per cent. than in 1891, being least in the small exchanges, and following a fairly well graduated scale of increase to the highest average, which is found in the large cities.

In 1886 the total number of exchange connections per annum was computed at 312,605,000. In 1892 it is estimated to have been 600,000,000.

The general average of such connections originating at each station is 8⅗ per day; that is, each subscriber, on the average, is placed in communication upward of 16 times with others in the same exchange, as compared with an average of 11.6 times, which was the record of six years ago.

The large addition to the number of subscribers for metallic circuits is noted with gratification, as a proof of the appreciation of the advantages which this class of service is found to afford. At the beginning of the year the metallic circuit equipment numbered 11,584, and at the close of the year they numbered 23,053.

Concerning the criticism which has at times been made that the rates at which the service is furnished in the larger cities are disproportionately high, as compared with those charged in smaller exchanges, the report says:

"Setting aside the consideration that in the larger city, containing some thousands of exchange stations, the use made by each subscriber, and the value to him of telephone facilities must inevitably be much greater than they would be in an exchange of less importance, it is also the fact that in exchanges above the limit of a few hundred subscribers, the cost of maintaining and operating each station bears a close relation to the numerical size of the exchange and the extent to which each station is used, rising in the large cities to an amount several times as great as the cost in the average of the small exchanges.

"The necessity of bringing the service to the highest attainable standard of excellence to meet the needs of a great business community; of employing a corps of the best skilled officials large enough to meet any probable emergency of the service; the higher rates of wages, rents, taxes and transportation which prevail in the larger cities; the expensive character of construction and maintenance, inseparable from the conduct of business in densely populated sections, where proximity with electric light and power currents is difficult to avoid, combine to enhance the cost to the company operating the exchange."

FROM BOSTON TO CHICAGO.

During the year the work of connecting together the territories of the different licensees has taken a great step forward.

It will be remembered that in the last report the intention was announced of the Long Distance Company of filling the gap between Cleveland, O., and Hammond, Ill., thus giving through service between Boston, New York and Chicago.

This has been done; that company having added to its construction during the year 494 miles of pole line and 8,645 miles of wire, of which 365 miles represents the extension from Cleveland to Chicago, and about 74 miles, a spur connecting Detroit, by the way of Toledo, with the through line, and the remainder, some 93 miles, the joint construction and reconstruction upon the Hazelton and Altoona line in Pennsylvania.

The general route of the line to Chicago is by the way of Newark, N. J., Harrisburg and Pittsburgh, Pa., Cleveland and Toledo, O., and South Bend, Ind.

To determine the feasibility of transmitting speech over the heretofore unapproached distance of 1,000 miles—the limit of successful transmission had not exceeded 500 miles—a special experimental circuit, consisting of two No. 8 hard drawn copper wires, were constructed.

This wire weighs 435 pounds to the mile, and the circuit contains 826,500 pounds of copper.

A circuit of the weight generally used for telephone service would weigh less than 200,000 pounds.

The success was so complete that the lines were at once extended to Boston, and two more circuits ordered strung from New York to Chicago.

"It is now possible," says the report, "from any properly appointed station on this system, to talk east to Portland, north to Concord, N. H., to Buffalo, N. Y., west to Chicago, and south to Washington, and, of course, to the principal cities intermediate."

In the eastern States, connecting lines already reach all important points. Through branches and through contemplated connecting lines of local companies, all important points in Ohio, Indiana, Illinois, Michigan and Wisconsin as well, will soon be reached.

It is noticed as an interesting fact that within that territory live and do business more than 50 per cent. of the whole population of the United States, so soon that no figure of speech to say that more than one-half of the population of the country are within talking distance of each other.

In building these lines, in bringing the existing plants up to the lever of the latest knowledge, in adapting them for use on so extended a scheme, and in yielding to the public demand in the more thickly settled portions of the large cities that the wires should go underground—in these various branches of work more than $35,000,000 have been expended, principally within the past six years.

In the last annual report it was stated that the long-pending application of Berliner for a patent for the microphone, an invention acquired by the predecessors of this company in the early days of the 'phone, had been allowed by the Commissioner of Patents, and that the patent had issued to the company, bearing date November 19, 1891.

This year the report states that the Edison application for a patent for the carbon telephone has also finally met with success, and resulted in patent No. 474,231, granted to the Western Union Telegraph Company, as assignee of Edison, May 3, 1892.

The carbon telephone patent will be controlled by the American Bell under its agreement with the Western Union.

It is added, however, that Edison's foreign patents for the same invention, although applied for subsequently to the application in this country, had expired previously to the grant of the American patents.

The company is advised by counsel that the law is unsettled whether in such cases the application should be defeated by the expiration of the foreign patent, but that the better opinion is that the fate of the foreign patent is immaterial.

THE FIRST PATENT.

Concerning the expiration of Bell's first patent, the report says:

"The expiration on March 7, 1893, of United States patent numbered 174,465, issued to Professor Bell, occasioned some confusion in the public mind, owing to the fact that it was not clearly understood that Professor Bell's patents were two in number, the second of which, numbered 186,787, dated January 30, 1877, will continue in force until January 30, 1894. The subject matter of this patent was defined as follows by Mr. Chief Justice Waite, in giving the decision of the Supreme Court of the United States in the telephone cases (126 United States Reports, 572):

"The patent itself is for the mechanical structure of an electric telephone to be used to produce the electrical action on which the first patent rests. The third claim is for the use in such instruments of a diaphragm, made of a plate of iron or steel or other material capable of inductive action; the fifth, of a permanent magnet constructed as described, with a coil upon the end or ends nearest the plate; the sixth, of a sounding box as described; the seventh, of a speaking or hearing tube as described for conveying the sounds; and the eighth, of a permanent magnet and plate combined. The claim is not for these several things in and of themselves, but for an electric telephone in which these things or any of them are used."

An impression has gained some currency that the patent upon the Blake transmitter expired on the 20th of January, 1893, because of the expiration, on that date of certain foreign patents which were taken out on Mr. Blake's invention. But Mr. Blake's original application was filed in the United States before any application abroad, and, under these circumstances, although the supreme court has not passed upon the question, it is considered the better opinion that the Blake patents are still in force.

THE GOVERNMENT SUIT

against the American Bell Telephone Company and Alexander Graham Bell still continues.

The defendants have until January 25, 1894, to complete their evidence, should they wish so much time.

In the matter of the new suit brought by the government against the Bell company and Emile Berliner the report says:

"One of the latest acts of Attorney-General Miller, before returning from his office, was to institute a suit to annul the Berliner patent. For that purpose, on February 9, 1893, the government filed its bill of complaint in the circuit court of the United States for the district of Massachusetts. The bill charges particularly that the original application did not cover the microphone, but was only made to do so by unlawful amendments, that Berliner was not the original and first inventor of the microphone, and, above all, that the progress of the application in the patent office was wrongfully delayed."

In the course of proceedings the brief or argument which had been filed with the Attorney-General, and on which he was asked to take action, was sent to the Interior Department and the Patent Office for consideration and report. The commissioner gave the matter exhaustive examination, and said in conclusion:

"I do not believe that a suit to repeal this Berliner patent is justifiable."

This report was sent to the honorable Secretary of the Interior, who in turn, sent it to the Attorney-General with a communication containing an expression of his own belief that Berliner's was the mind that made the invention covered by the patent; that the amendments complained of were made in due course, and that there were no extraordinary delays in the prosecution of the patent imputable to Berliner or his representatives.

"I am advised," says President Hudson in conclusion, "that it is without precedent for the department of justice to bring a suit to annul a patent without first obtaining from the department of the government from which the patent issued an expression of opinion that the suit ought to be brought."

A ballot for clerk resulted in the re-election of Mr. Charles Eustis Hubbard, while Mr. William R. Driver, the present treasurer, was also elected to succeed himself.

The election for directors resulted as follows, there being no contest:

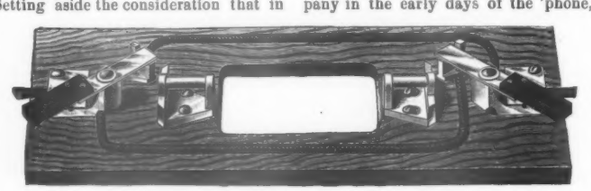
Thomas B. Bailey, Francis Blake, Charles P. Bowditch, George L. Bradley, Alexander Cochrane, William H. Forbes, Henry S. Howe, Charles Eustis Hubbard, Gardiner G. Hubbard, John E. Hudson, Charles E. Perkins and Thomas Sanders.

It was voted to have the annual report printed and placed on file, and a copy sent to each of the stockholders.

It was also voted to increase the capital stock from $17,500,000 to $20,000,000, and that for each seven old shares the holder shall be entitled to one of the new issue.

It was recommended that the stock be issued one-half July 20 and the other half on October 20, when the meeting adjourned.

A meeting of the directors was called at 12 o'clock, when Mr. John E. Hudson was re-elected president for the ensuing year, and the recommendation regarding the time when the new stock shall be issued adopted.



THE DOW HANGER BOARD FOR ARC LAMPS.

The Dow Hanger Board for Arc Lamps.

In order to meet the demand for a first-class ceiling board to be used in connection with arc lamps, Mr. Alex. Dow, the well-known electrical engineer of Chicago, has designed the one shown in our cut. This has a number of novel features which will commend themselves to those who have had experience with other hanger boards. It has a central opening through which the tubes project, the lamp itself being hung on the brass supports next to this opening. The wires can be run into the binding clamps from the end, as shown in the illustration; or they may be bent at right angles and inserted transversely, so as to allow of their being drawn taut without pulling them out of the clamp. Another peculiar feature lies in the two simple but effective switches which make the board an absolute cutout. In ordinary practice, only one of these would be used, but if the lamp is to be trimmed, both switches are thrown to the "off" position, leaving the lamp entirely disconnected from the circuits. The Dow hanger board is built in both the oblong form, for double carbon lamps, and in round form, for lamps with a single carbon. It is being put on the market by George Cutter, of Chicago.

Electrodes for External Use.

BY R. G. BROWN, E. E., IN THE "BROOKLYN MEDICAL JOURNAL."

There is a general complaint among doctors engaged in electro-therapeutical practice that electrodes used for making external contact, such as are to be found in the market, are unsatisfactory. The object of this article will be to describe in detail an electrode for external use that will meet all requirements, and, moreover, one that can be made at home. This latter feature will be most appreciated by those residing at a distance from the center of supplies, and will, therefore, be described in such manner that those desiring to make it for themselves will be enabled to do so.

An electrode for external use should possess the merit of allowing a comparatively high current to be used without causing a burning sensation to the patient. It should

be capable of being easily and quickly applied, and should be clean and pliable. It should not wet the patient's clothing, should be simple in construction and readily made in any shape desired to suit circumstances.

The contact material must therefore be a substance possessing a good and even conductivity and one which will lie in absolutely perfect contact with the skin, thus permitting the current to be evenly distributed over the entire surface covered.

At the supply houses, electrodes are to be found of every variety, made of sponge, felt, absorbent cotton, clay and even bags of skin filled with water.

The sponge electrode to be of any service must be so thoroughly wet that the slightest pressure put upon it will squeeze the water over the patient, and unless a sponge is held by pressure in close contact with the skin it is of little use, for the reason that the current will be so unevenly distributed from its surface that the using of a high current is out of the question, that is, without causing a severe burning sensation to the patient—a high current may be qualified in this case, at say 100 milliamperes. In fact, the sponge might well be discarded as being altogether too much of a honeycomb structure for good work.

Felt, although of a close texture, is really a miserable absorbent and can never be made to lie in sufficiently close contact to the skin. It will curl away at every opportunity. The material known as "spongio-pyline," consisting of a mixture of sponge and felt, is practically no better than the felt, and for the same reasons.

Absorbent cotton is not sufficiently porous; in fact, it packs to such an extent that it gets lumpy, and then becomes an uneven distributer for the current.

Clay, to be serviceable, must be kept well kneaded and moist, and when thus applied as a poultice will give good results. It is, from an electrical standpoint, the best, by far, of all the electrodes above enumerated, but on the other hand, it is so cold, unclean and troublesome to keep in condition that it is rarely used.

Briefly, the new electrode to be described consists of a piece of "amadou," first made moist and laid upon the patient, and on this, but a little smaller than the amadou, is laid a soft piece of perforated brass, having suitable device to connect with the battery.

Amadou is a species of fungus—a substance which grows upon old trees in England and on the continent of Europe. When prepared for market it has the appearance of soft leather, It will readily take up more than its weight of water, and in so doing contracts to at least half its former size. When saturated with water it has a fleshy touch and will readily conform to the irregularities of the body.*

This substance will remain moist for a long time, and a sand bag or other pressure may be put upon it without fear of water running from it over the patient. It is exceedingly porous, and when thoroughly wet forms an excellent conductor. The current is evenly distributed over the whole surface covered by it, and consequently no burning spots are experienced by the patient.

The metal used is a plaque, or flat piece of perforated brass, known in the trade as No. 15. It is beautifully smooth on one side, and owing to the punches of the machine in making the perforations is slightly rough on the other. It can easily be cut with an ordinary pair of scissors, to any desired shape, care being taken to follow the perforations in such manner as to leave an unbroken edge all around the plaque as shown in the figure.

After having cut a piece as described, it should be annealed by holding it over the flame of a Bunsen burner, or placed on the hot coals of a fire until cherry red, and then thrown into a pan of cold water. This may be repeated, when it will be found to be as pliable as a piece of lead.

A small strip of No. 15 brass, half inch wide and one and one-quarter inch long, should be corrugated one-half its length, and to the rough side of the perforated plaque should be soldered at one end, leaving the corrugated end slightly raised to receive the connection tip, which will be presently described.*

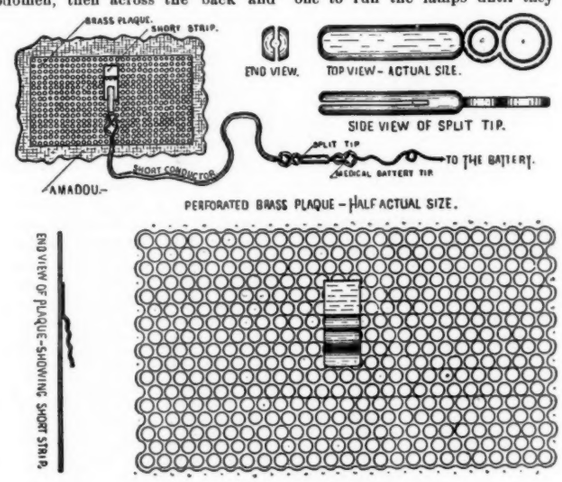
The flexible conducting cord from the battery is connected to the perforated plaque through the intermediary of a short and well insulated piece of flexible conducting cord, having at each end a split tip of special design. This special tip is shown in the figure and consists of a short piece of spring brass rod one-quarter inch in diameter and one inch long. A small hole is first drilled through it longitudinally; it is then split by means of a saw down three-fourths of its length, and in the other end is inserted and soldered one of the ordinary tips that come with medical batteries.

They are made slightly flat on two sides, so as to lie low when connected with the plaque.

This intermediate conducting cord is some 15 to 20 inches in length and is made up of three lengths of the ordinary uninsulated tinsel conductor, twisted together and pulled through a piece of small rubber tubing, which they will just fill. This gives a strong, well insulated and flexible cord, and to the ends are attached, in the usual manner, the special split tips just described.

The conducting cords which connect directly with the battery, terminate in the ordinary medical battery tip as shown in the sketch.

The short intermediate cord is a valuable aid in practice; for instance, it is often found desirable while having one pole of the battery in continuous connection internally to have the other pole connected first over the abdomen, then across the back and again over the abdomen, thus changing back and forth several times during the treatment. To move the external electrode each time would not only inconvenience the patient, but would be an actual detriment to the treatment, besides causing a loss of time.



DIAGRAMS OF BROWN'S ELECTRODE.

In practice, two external electrodes of large surface are used, each having connected to it one of the intermediate cords. One electrode is placed in position under the back and the other across the abdomen. It is then a simple and quick matter to detach the battery cord from one and connect to the other, as desired.

To make the connection between the plaque or external electrode and the short cord, the little brass strip of the plaque is forced into the slit of the tip, the corrugations on the former retaining it in place and assuring a perfect connection.

The battery cord proper is connected to the short cord by pushing the pointed tip of the former into the longitudinal hole of the latter.

* It is difficult to find large pieces of amadou in the New York market, but they can be had at 20 francs the kilo (two pounds) of Vve. T. P. Brun & Fils, 19 Rue des Halles, Paris.

* These tips, complete and nickel-plated, can now be had from the Jerome-Kidder Company, 820 Broadway, New York.

To solder, procure a soldering iron, known in the trade as a 1½ I. X. L., a small bottle of soldering acid and some "wire" solder. Heat the iron, but never to a red heat. Put a drop of acid and a small piece of the solder on the perforated plaque at the spot where the small strip is to be fastened and apply the iron, which will cause the solder to run. Then do likewise to the smooth end of the strip. Having caused solder to adhere to both, hold the small strip down on the plaque, by means of a lead pencil or like article, and apply the iron, when they will unite. Do not heat the iron over an ordinary gas jet—soot will form and interfere with making a good job.

The perforated brass, No. 15, is made 2¼ feet wide, and costs 28 cents per square foot.

The brass strip No. 15, ½ inch wide, costs three cents per running foot; and all can be had at Patterson Brothers, 15 Park Row, New York.

The Most Economical Age of Incandescent Lamps.

DISCUSSION OF MR. CARL HERING'S INTERESTING PAPER BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

Mr. Carl Hering's paper on "The Most Economical Age of Incandescent Lamps," published in the ELECTRICAL REVIEW for April 1, has been the subject of the following discussion before the American Institute of Electrical Engineers.

Prof. Benjamin F. Thomas: I am indebted to Mr. Hering for a copy of his very interesting and valuable paper and for the opportunity to contribute a little to its discussion. All who are interested in any way in incandescent lighting, must, with me, feel under obligation to Mr. Hering for the application of the O'Keenan analysis to the data of the Ohio test, and for his skillful interpretation of the results. The original paper and its discussion at Chicago established the fact that lamps last altogether too long for economical results, and also the fact that the lamp of highest initial efficiency is not always the most economical. Mr. Hering's paper now turns the conclusions there expressed in general terms, into a complete demonstration, and adds other facts which will doubtless prove quite surprising to many who have made lamp questions a study. If the results are properly understood and applied, they must prove to be of great value to the lamp manufacturer, the station manager and his customers, and all who have anything to do with incandescent lamps. To the owners of isolated plants, Mr. Hering has demonstrated the importance of renewing lamps when they read the point of minimum cost. (Why not call it the O. K. point?) It hardly seems right, however, to advise any one to run the lamps until they "die a natural death" when the amount of light afforded is not important. Economy considered, it is better to use, in such place, lamps of the lowest allowable candle-power, and to renew them as elsewhere. Central station managers, who furnish lamps to their patrons, without specific charge for lamp renewals, and who charge by meter record, will of course find it pays best to run the lamps just as long as they can, without causing enough dissatisfaction to seriously affect the number of customers they have. A rough calculation shows that even this care may profit by the deductions of Mr. Hering. The manager who runs a lamp 1,200 hours, instead of renewing at 400 hours, loses 12 cents of profit which he would have made on the larger current which would have passed through the lamp and meter, if he had renewed at the proper time. The strenght of the current which flows through the lamp diminishes as the lamp grows old, and therefore the watt hours which will be recorded will be less during the last half of the natural life of the lamp than during the first half. This is of course equivalent to decreasing the station out-put, when lamps are burned as long as they will last. If we ever have lamps produced and sold at about 15 cents it will then be best for station managers of the class supposed, to renew at the 400 or 500 hour point.

It is interesting to note that the man who is a customer of such a central station will find it profitable to buy his own lamps, even though no deduction be made in the price charged by the station. The higher average candle-power of the lamps when renewed each 400 hours, will enable him to light his premises equally well with a smaller number of lamps, and the saving in his meter bill will more than pay for all the lamps used, and he will have a more uniform and more satisfactory light. It seems not improbable that the central station of the future will limit itself to supplying current through its mains, the one who buys current furnishing his own lamps, fixtures, wiring, etc., and the fact last considered ought to be helpful in bringing about that state of things.

Mr. Hering's Fig. 3 furnishes a very striking view of the relative values of several lamps as money savers. At 400 hours, lamps A, K, F and M, are very close together, the extreme difference in cost of 1,000 candle hours being only one cent. Where the difference in cost of light is so small, it matters little which lamp be chosen, unless the user of the light is particular about uniformity of candle power during the 400 hours.

Referring to Table IV of the paper read at Chicago, the percentages of original candle power were, at 400 hours, for A, 74 per cent.; for F, 77 per cent.; for K, 78 per cent.; and for M, 90 per cent. The M lamp is therefore best, when uniformity of candle-power is deemed important. It must be borne in mind, however, that the number of lamps of each make tested was too small to base a sound judgment of relative merit on, and the above comparison must be considered as an illustration only.

Prof. Elihu Thomson: I have received the advance proofs of Mr. Hering's paper on incandescent lamps. I have very little time at present to add anything to the discussion of the matter. I think his points are well taken, but I also think he is quite right in pointing out that they are theoretical rather than practical. I think his practical rule for the running of lamps, which, as stated by the paper, is to run them until the diminution of incandescence becomes noticeable and then discard them, is a very good one. Whether to break them or not is another question. They are, of course, still capable of being run at a high incandescence for a short time if the voltage be increased. In fact, looking at the matter again from a purely theoretical standpoint, it strikes me that the ideal condition for running is to start the lamp at the potential for which it is made and gradually increase the potential so as to keep up a fair or uniform light efficiency regardless of the life of the lamp, letting the lamp go when it will. Of course, this is not practical in most systems, but it can be approximated by putting the older lamps on parts of the system which have the highest potential where there exist differences of potential. It also strikes me that the calculations will need to be varied with every change in the time of running of a lamp; in other words, if out of a set of lamps there are some which only run a short time for each day while others run a much longer time, the time for discarding a lamp will vary, theoretically, in this case. The short time lamps demand, theoretically, a higher light efficiency throughout their use.

It still remains, after the discussion, that we should not relax our efforts to obtain a lamp with long life, and one having an economical efficiency during that life. Furthermore, it is evident that the longer the life of the lamp, if the economy of the light production is maintained, the less in proportion becomes the cost of renewal to the other expenses. There is something to be said also on the score of the convenience of use of the long life lamps as against a lamp which runs down rapidly, which, in a discussion like this is liable to left out of the question. Where lamps require to be renewed very frequently and are somewhat inaccessible in their placing, the long life lamps have an advantage in the saving of labor.

In my opinion, the development of the manufacture of incandescent lamps will give rise to the production of lamps of short and long life to suit the varying conditions in practice and the relative cost of power to cost of lamp renewals.

Prof. E. P. Roberts: It was my intention to attend the meeting of February 21; having, however, changed my plans and being very much rushed, I only have time to drop you the following brief memoranda:

1. An instructive line of investigation, following the method of Mr. Hering's valuable paper, would be to determine the comparative value of lamps "L" 3.8 watts at start, 5.5 at 500 hours and "M" 4.8 at start and 5.1 at 500 hours.

2. Undoubtedly, blackened lamps should be either destroyed or used where amount of light is of little consequence, or used for resistance racks.

3. That as long as lamps have a 90 per cent. probability of being operated anywhere from two per cent. below normal voltage, to from 10 per cent. and upwards above that, the practical rule, "Smash blackened lamps," should be supplemented by, "Pay the interest on $75 for a first-class portable voltmeter, use same frequently and systematically all over circuits and give the medicine called for by the diagnosis," which might be further supplemented by, "If, after knowing the disease, you will not pay for the medicine necessary to make a cure, do not complain if patients die young."

(*Continued on page* 102.)

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Our esteemed contemporary, the *Engineering and Mining Journal*, has found it necessary to open a London office. We congratulate the *Journal* on the state of prosperity which this departure would seem to indicate.

We have had a request for the address of a storage battery supply company in New York. If there is a concern in this city making a specialty of charging and delivering storage batteries on rental we shall be glad to receive its address.

It seems that the Order of Commercial Telegraphers, which has been quietly gaining strength for some time, and the Western Union Telegraph Company have come into conflict. We do not believe that the immediate results will be of serious importance to either side.

Cooking is constantly growing to be more of a science. As the epicurean palates of our wealthy people discuss the delicate conceptions of their French chefs, little do they think of the how or wherefore. It is enough that the viands look tempting. And what do the gentlemen, who in some cases draws a yearly salary in the thousands, think of the means afforded for the preparation of food? Like all apprentices who have grown up under the eye of the master, they are conservative, but it may be said that there are some of them who have grown liberal and are waiting to welcome the electric stoves, ranges, ovens, etc. Overheated kitchens will be done away with, electrical dishwashers and dumb-waiters will appear; in short, the kitchen of the twentieth century will be a realization of Jules Verne's vivid description of the culinary department in the "Nautilus."

We have lately heard it said that Henry Goebel isn't dead; so read the papers, mind your eyes, and you won't be taken by surprise.

American cable manufacturers are enjoying a good run of business at the present time. More submarine and subterranean electric cables are in use to-day than ever before.

The manufacturers of high grade insulation will now be sought out, since several costly fires, said to be due to inferior insulation, have recently occurred. Cheap work in the electrical field never pays.

With the advent of spring business in the electrical field is looking up after the comparatively dull lethargy of winter. New equipments are being ordered in quantities and a considerable number of new manufacturing establishments are being erected.

An interesting series of bargain sales, which, however, does not appeal to the ladies, will be held at Roxbury crossing, near Boston, during this month, with a final closing out sale on May 2 of all goods then remaining unsold. Over 2,000 lots of merchandise will be disposed of at auction and it will be the last chance the public will have to secure bargains of this kind. The goods offered are now out of season and will therefore be closed out at bargain counter prices. The corporation whose goods will thus be sacrificed is the largest in its line of business in the world and the only excuse it offers for this unprecedented cut sale is the fact that it needs the room heretofore occupied by this stock for the installation of modern improvements. Come one, come all! Department A, first floor middle aisle, Roxbury crossing stables, West End Street Railway Company's sale of 2,000 horses!

Wails are coming from all over the country which, upon being translated and revised, formulate themselves into the simple question, "Why are the wires not buried?" One jovial individual, the editor of the *Bugville Howler*, declares in a burst of oratory, "Come all ye undertakers, business is rushing. The telephone and telegraph wires are still above ground. The sword of Damocles is above our heads." Another similarly gifted writer says—and we can imagine him chuckle to himself as he rolls this child of his brain around his mouth: "Fellow-citizens, which shall we bury, the inhabitants of this glorious and growing city or the terrible telegraph wires?" Still another "moulder of public opinion" says to his anxious readers: "Don't, for God's sake, ever touch a wire that is hanging in the street; they are all loaded to the muzzle with extra deadly electricity." It seems as if the number of calamity howlers is as great as ever and old Father Time and his scythe are incapable of thinning them out.

THE AMMONIA MOTOR.

A great deal is being promised for the ammonia motor, and if anyone directly, *i. e.*, pecuniarily, concerned is approached and asked what he thinks of its future, he will, no doubt, answer with a few artistic and highly impressive flourishes, "Why, my dear sir, electricity isn't in it!" And then he will deluge you with facts (?) concerning the almost absolute impossibility of appreciating the cost of running a car for a mile, the amount is so small, until your eyes fairly bulge, if you are gullible, and you begin to think what you can sell to obtain enough money to buy some stock. One advantage that someone, who did not know anything about it, claimed is interesting: "You see," he stated, "sometimes the cars are so crowded that a lady faints. All you have to do is turn the stopcock a little, let out some ammonia, the lady revives, and there you are. Oh, it's a great thing!" But, and with a big B, there is an African concealed in the woodpile somewhere, and all at the present time that the motor successfully does is to allow itself to be praised to the skies. If we remember aright Mr. Shakespeare once said: "Oh, what a fall was there, my countrymen!"

LETTERS FROM A LABORATORY.—XXXIX.

BY JULIAN A. MOSES.

There is a little toy which has had and does still have its uses as furnishing a means of enjoyment to the younger generation. The marble, in a measure incorrectly named, although the first specimens may have been made of that material, not only has its application for the furnishing of recreation but it may serve the experimenter in several ways.

There are several varieties of marbles and the different materials of which they are composed render these little spheres valuable. The principal varieties are made of the following substances: Clay, glass, porcelain and agate or carnelian. All of these materials are unaffected by the common stronger acids, hydrofluoric excepted, and may be used as temporary stoppers for glass tubes containing liquids which require protection from the air and fumes which fill the laboratory.

The clay marbles being the cheaper, their cost being inconsiderable, may be used in the more extensive work, while the glass, porcelain and agate kinds, which have the property of hardness in a more marked degree, should be employed in the cases requiring accuracy and durability.

The uses to which they may be put are not generally known, but a few to which they may be applied in the laboratory may prove an interesting addition to the many accessories which go to make chemical and electrical manipulations more of a pleasure than otherwise.

Agates, which may be purchased of various sizes, from one-quarter to an inch and a quarter or more in diameter, are not expensive; they range in price from three to 50 cents and upwards. They make excellent feet for instruments, which do not require leveling and are ornamental as well. They may be attached in several ways. If the base or bottom is of wood, it is best to drill, with a rose bit, an indentation into which the marbles may be put to stay by applying a little pressure so that the diameter of marbles is about a sixteenth of an inch under the surface of the wood. If the diameter of the bit is the least bit smaller than that of the marble the fit will be accurate, and the application of a little shellac in alcohol will be sufficient to hold it firmly in position. If the wood is very hard, or if the base is of ebonite, it is preferable to drill but a very shallow indentation about one-eighth the diameter of the marble with the rose bit. The marble should now be heated and a little marine glue or some other equally adhesive cement smeared upon it. The indentation in the wood may now be warmed by the introduction of a heated piece of metal in order not to chill the cement too quickly when the marble is placed in position. If the base is of brass or other metal, these agate balls, which must, of course, all be of exactly the same size, may be soldered to it by first heavily copper-plating and then cutting away a little less than one-half of the copper shell, soldering neatly the other half to the base in the usual manner. These agate balls come in very handily in many ways, and are very convenient to have around the laboratory, for they are very nearly perfect spheres and take the place of wooden or metallic balls which so often come into use.

It is required to obtain a comparatively flat surface on the agate ball; this may be done by grinding off a portion on a medium coarse emery wheel and finishing off on the flat side of a fine emery wheel and a leather revolving surface spread with rotton stone and oil or any other mild abrasive composition. When a perfectly accurate, flat surface is desired it is advisable to use a lead or pewter revolving surface plate which must be "chattered" by holding a knife edge against it as it turns slowly in one direction and reversing the angle of the knife blade while turning it in the opposite direction. This "chattering" makes little ridges in diamond form which hold the emery powder and prevent it from flying from the plate when the agate is pressed upon it. For fine finishing a copper revolving plate is recommended, moistened with fine emery and lard oil. Drilling agate is a difficult operation. Small holes require a diamond drill and are to be avoided if possible.

There is another use to which these glass or porcelain marbles may be put, *i. e.*, for the purpose of facilitating the movements of drawers in cabinets. If a small groove be cut in each "way" underneath the bottom of the drawer and two or three marbles be placed so that they act as rollers, the Recording Angel will be saved many a stroke of the pen.

CORRESPONDENCE.

OUR BOSTON LETTER.

The Clinton Wire Cloth Company has decided to substitute electricity for gas in the lighting of its extensive plant, and the necessary machinery is now being put in.

Messrs. Westinghouse, Church, Kerr & Company, of this city, have the contract for equipping the new power station of the Newton & Boston Electric Railway Company, which is now under construction. They will install apparatus of 1,000 horse-power.

The Massachusetts Chemical Company are equipping their plant with additional machinery for the manufacture of their new black insulating paint, which is particularly adapted for all electrical purposes, as it will neither crack, burn off nor oxidize under the severest possible tests. It partakes very much of the nature of their already famous insullac, and will be known as "insullac paint."

George A. Beatey, the hustling electrical engineer, of No. 620 Atlantic avenue, is organizing a syndicate to build and operate a large system of electric railway and electric light plants, and has already enrolled a number of prominent and wealthy business men of New England in the enterprise. They also propose to take construction contracts for local companies, and will put in complete outfits of both steam and electric apparatus.

The Woonsocket Electric Machine and Power Company, of Woonsocket, R. I., have increased their capital from $250,000 to $400,000, and will immediately purchase a site and install the necessary apparatus for the operation of the lines of the Woonsocket and Suburban Electric Railway Company. They will also supply current to the Electric Lighting Company, at Franklin, Mass., and as soon as possible will extend their lighting service to several other towns in the vicinity.

The Newton and Boston Street Railway Company has decided to furnish its own power for operating its line from Newtonville to Newton Upper Falls. Previous to this time all the roads operating in Newton have been supplied by the Waltham Electric Light and Power Company. A plant of sufficient size will be established to supply not only the Upper Falls line, but also several of the other electric roads projected for this part of Newton. The necessary permit has been obtained from the Board of Aldermen, and the company will at once proceed with the erection of a large power house at the intersection of Homer and Walnut streets, Ward 6. The building will be a large wooden structure, and will be fitted up with a 375 horse-power engine and complete electrical apparatus.

A Meeting of the Creditors of the Germania Electric Company was held in this city on March 28, at which a report of the condition of the company's affairs was submitted by Assignee Williams. That these are in exceedingly bad shape there is no room for doubt, and should their available assets be disposed of at a forced sale there would be little if anything left for distribution among the many creditors. The meeting was rather an informal one, and was called by the assignee with a view of laying the condition of affairs plainly before the creditors and getting their views on the future policy to be pursued. No particular course was decided upon, but the general sense of the meeting seemed to be that the plant and machinery should be kept intact, if possible, until such time as the company would be in a position to continue the manufacture of their lamps. Confidence was expressed in the ability of the assignee to handle matters for the best interest of all concerned, and no disposition was shown to push the company to what would prove under present circumstances a disastrous settlement. Arrangements will probably be made to dispose of such stock and available assets as may be allowed by the General Electric Company, and the plant leased or otherwise made self-sustaining until the expiration of the lamp patents, when the company will continue their business as heretofore. If this is done they express perfect confidence of being able to pay 100 cents on the dollar for every outstanding claim against them.

Boston, April 1. H. G. T.

OUR CHICAGO LETTER.

At a Meeting of the County Commissioners at Dunning this week, the residence committee reported the awarding of the contract for the additional electric lighting for the county buildings and the new hospital pavilion at that place to the McFell Electric Company, this city.

Work was Commenced this week on the fine painting of the exterior of the big buildings at Jackson Park. The first structure to receive the attention of the painting brigade was the manufactures building. The coloring is pale cream and not pure white as has been announced. The transportation building is being decorated in all sorts of colors. The electricity building and the remaining structures will be almost uniformly of a pale cream color.

A. H. Atwood has sold outright his electric arc lamp patents to F. P. Little & Company, of Buffalo, N. Y. This new firm will manufacture the lamps on a large scale, and having secured a good lamp will, no doubt, build up a big business in this line. The machinery for the manufacture of these lamps has been shipped and will be installed immediately upon arrival at Buffalo. Mr. Atwood will hereafter devote his entire attention to manufacturing carriage lamps and plated harness mountings.

The Contract for the Equipment of a Storage Battery Plant at Jackson Park was given to the General Electric Company by the Expositon management this week, and when completed it is claimed that it will be the largest storage battery charging plant ever erected. The plant will be used for charging the storage batteries of the electric launches used on the lagoons and will be sufficient in capacity to charge at one time 60 electric launches each having a capacity of 78 cells. This will be equivalent to a current sufficient to maintain 6,000 incandescent lamps.

Personal.—Frank S. DeRonde, general sales agent of the Standard Paint Company, New York, was in the city this week.—Albert Fisher, Western representative of the Watertown Engine Company, Watertown, N. Y., reports the sale of several large engines during the past month.—Mr. A. H. Englund, manager of the International Register Company, has just returned from a trip South, and reports having done a fine business.—Mr. Oscar M. Gibbs, supreme secretary of the Order of Commercial Telegraphers, is in the city making arrangements to establish the headquarters of this order in Chicago.

The Merchants in the Town of Lake have been complaining lately of the rate which they are being charged for arc light service, and a petition is now being circulated which is signed by many property owners and will soon be put in the hands of the Council Committee for a consideration. The rate paid in the towns of Hyde Park, Kensington and South Chicago is much less than for the town of Lake, and it is also claimed that the lights are much better and are furnished longer hours. The petition requests the council to secure for the residents a reduction, or else compel the Arc Light and Power Company to give the right of way to competing companies.

Chicago, April 1. M. J. B.

GENERAL NOTES.

The Carondelet, Mo., Electric Light and Power Company has decided to continue on sinking the well just south of the plant.

It is said that a number of prominent capitalists of northern New York are about to establish a big electric plant near Glens Falls, and that to furnish power for the enterprise the Hudson river will be dammed a few miles above Glens Falls. It is said that the plan is to furnish electric light for Glens Falls, Sandy Hill, Fort Edward, Saratoga Springs and probably Lake George.

The annual meeting of the stockholders of the Fall River Electric Light Company was held recently. The entire capital of $120,000 was represented. By a unanimous vote is was decided to petition the legislature for permission to amend the charter of the corporation, in order to enable the company to supply power as well as light. The report of the treasurer showed a prosperous condition of affairs, and the business of the year has been satisfactory. The old board of officers was re-elected.

The McKeesport, Pa., Electric Light Company's plant caught fire on March 31 and was totally destroyed. The loss will be from $75,000 to $100,000. The blaze was caused by a torch in the hands of an oiler coming in contact with a bunch of oil-soaked waste, which communicated the flame to an oil barrel, which exploded, scattering the fire in all directions. The city public highways were in darkness, and the Duquesne Electric Railway and Citizens' Electric Railway were also left without power.

New Trolley Cars Burned.

On Monday morning, April 3, the car house of the Orange Electric Railroad Company, at Fourteenth street and Central avenue, Roseville, N. J., was destroyed by fire, together with 26 cars and other property belonging to the New Jersey Traction Company. The total loss is estimated at $100,000, covered by insurance.

Another Important Decision.

On March 27, Judge Blatchford, of the Supreme Court, handed down a decision in the case of Huber *vs.* Nelson, in which the court decided that a foreign patent having lapsed, by reason of non-payment of taxes, an American patent granted thereafter for the same invention is void. This action, it is claimed, destroys the three microphone patents owned by Mr. Edison.

Attention was called by the judge to a decision of the Supreme Court, March 24, 1890, in which it was held that a United States patent ran for the term for which the prior foreign patent was granted, without reference to whether the latter patent became lapsed or forfeited after the grant of the United States patent, by reason of the failure of the patentee to comply with the requirements of the foreign patent law. "It seems, however," said Judge Blatchford, "that the case referred to did not distinctly cover the present one, because in that case the foreign patent was in force when the United States patent was granted."

The rumor has spread that this decision affects Mr. Edison's quadruplex and microphone patents.

Mr. R. N. Dyer declares that this current report is without foundation for the simple reasons that the quadruplex patents have already expired, and that the case Huber *vs.* Nelson is in no way similar to that of the microphone patents.

PERSONAL.

Nikola Tesla and James I. Ayer have been elected honorary members of the National Electric Light Association.

Among the visitors to New York last week were Col. L. W. Burnham, of the Electric Gas Lighting Company, Boston, and Mr. Geo. F. Talcott, of the Campbell Electrical Supply Company, Boston.

The Hon. John F. Noonan, a well-known telephone magnate of Newark, favored the ELECTRICAL REVIEW with a pleasant call last week, and reports that New Jersey telephone subscribers are getting excellent service.

Mr. John A. Cabot, formerly with the Cincinnati Edison Company, was appointed city electrician of Cincinnati on March 28. Mr. Cabot takes Mr. Robb MacKie's place, the latter gentleman arriving in New York on April 1 to assume his new duties as chief engineer of the "C. & C." Electric Motor Company.

We extend our hearty congratulations to Mr. W. J. Dealy, for eleven years manager of the operating and cable departments of the Western Union Telegraph Company, who was promoted on March 31 to the superintendency of the commercial news, stock and race department. His place will be taken by A. E. Sink, for a number of years night manager, who in turn will be succeeded by Edward F. Cummings, formerly his assistant.

Those Valuable Rules.

HALIFAX ILLUMINATING AND MOTOR COMPANY, LIMITED.
HALIFAX, N. S., March 25, 1893.

TO THE EDITOR OF ELECTRICAL REVIEW:

Can you inform us where we could procure a few copies in book form convenient for pocket use of "Rules for Electric Light Work," by James I. Ayer, as published in your issue of March 4?

Please reply through the columns of your REVIEW, and greatly oblige yours, etc.,

W. J. DE BLOIS,
General Manager.

[If Mr. De Blois will write to Mr. James I. Ayer, general manager Municipal Lighting and Power Company, St. Louis, Mo., we have no doubt he can make some arrangement for obtaining what he wants.—ED.]

The General Electric Company has declared a quarterly dividend of two per cent. on the common stock, payable May 1 to stockholders of record at close of business April 18. Transfer books close April 18 and re-open May 2.

Historical Exhibits at the Official Headquarters of the American Institute of Electrical Engineers at the World's Fair.

TO THE EDITOR OF ELECTRICAL REVIEW:

At the last meeting of the council of the American Institute of Electrical Engineers, the committee on ways and means, who have charge of matters pertaining to the official headquarters of that body at the World's Fair, presented a report, and the committee was instructed to insert a notice in the technical papers calling attention to the fact that the Institute had secured, through the co-operation of the authorities at the World's Fair, two rooms adjoining the offices of the Electrical Department in the Electricity Building. These headquarters are now being furnished, and the secretary of the Institute, Mr. Ralph W. Pope, will be in general charge of the headquarters during the exhibition, and the committee, on behalf of the council, wish to extend an invitation, not only to the members of the American Institute of Electrical Engineers, but to any and all of our foreign friends of the electrical profession who may visit our shores during the coming World's Fair, to use these rooms as their headquarters. Letters may be addressed in the care of the secretary at the headquarters, and in the furnishing of the rooms, facilities will be given for writing letters, meeting friends, reading technical papers which will be placed on file, leaving their parcels and securing general information upon the Electrical Congress and other meetings, and World's Fair matters generally. The rooms will be equipped with a long distance telephone and telegraph service, fire protection, and the authorities have promised to place one or more members of the Columbian guard at the headquarters. The Institute has decided to place in these rooms various objects of great scientific and historical interest, such as photographs, pictures, autograph letters, rare electrical books, models, instruments, etc. These things will be properly classified and arranged, and the committee request that all persons having objects which would prove of interest or value in this connection to communicate with the secretary, Mr. Pope, at the headquarters of the Institute, No. 12 West Thirty-first street, New York city, or with the chairman of the committee, Mr. William J. Hammer, 527 Temple Court, New York city. As we are somewhat limited for space, the committee will be compelled to select only objects which are not too bulky and which are of great interest and value, and they propose to make the headquarters of the Institute one of the most interesting features of the Electrical Department of the World's Fair. As the time is very limited, the committee trust that a prompt response will be given to this call, and that all the members of the Institute will feel a personal interest in seeing that the exhibit made shall be as full and as valuable as possible. The secretary was instructed by the council at the last meeting to extend an official invitation to the foreign electrical societies to avail themselves of the privileges of the Institute.

Committee—William J. Hammer, Francis R. Upton, W. A. Kriedler.

New York, March 29.

OBITUARY.

Gen. Edmund Kirby Smith, who was president of the Atlantic and Pacific Telegraph Company from 1866 to 1868, died at Sewanee, Tenn., on March 28 of congestion of the lungs.

We regret to learn of the death of Col. F. A. Mason, of Bridgeport, which occurred at Cromwell, Conn., on March 25. When attacked by disease of the brain, three years ago, he was treasurer of the Bridgeport Brass Company. Colonel Mason was born in Torrington 51 years ago, and commanded the Thirteenth Regiment, of Brooklyn, at the time of the Orange riots. He was formerly president of the People's Steamboat Company and a director of the Pequonnock National Bank. He leaves a widow, one son and two daughters.

Weston Electrical Measuring Instruments.

NEW TYPES AND IMPROVED DESIGNS OF WESTON VOLTMETERS AND AMMETERS.

The Weston Electrical Instrument Company, of Newark, N. J., manufacturers of the well known Weston measuring instruments, have recently effected a number of improvements in their product which will add to their already high efficiency. We present herewith illustrations of several types of these instruments, accompanied by brief descriptions.

The attachment of a steam gauge to a boiler is now universally recognized as such a necessary adjunct that no one would dream of operating a boiler without one. Yet there was a time when the mere safety valve was the only means furnished the boiler attendant for knowing the condition of the apparatus under his charge. The generation of current for electric light and power has passed through an exactly analogous course of evolution. In the early days the brilliancy of the pilot lamp was the only means the dynamo tender had of judging the voltage of his circuits, while the blowing of the station fuses gave him the first indication that there was "something wrong" with his circuits.

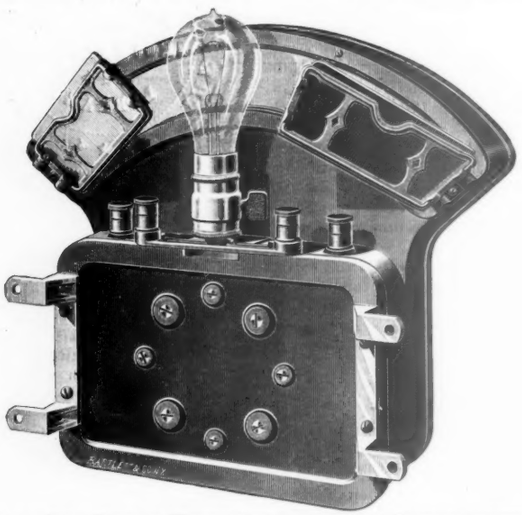

FIG. 1.—REAR VIEW OF WESTON ILLUMINATED DIAL STATION AMMETER.

An indicating instrument, to be of any value at all, must possess the following characteristics:

1. It must be theoretically correct in principle. This is almost a self-evident proposition; yet very few of the many instruments heretofore designed and put upon the market fulfill this condition, without which, of course, there can be no permanency in the indications of the instrument.

2. It must be accurate throughout its entire range. An instrument that is accurate at only two or three points in its scale is evidently not one which can be profitably employed in a station in which the fluctuations of load or potential are frequent and of wide range, as is the case in most lighting stations and particularly in electric railway work.

3. It must be simple in construction. Complication of parts introduces errors of indication of necessity, at the same time making the instrument liable to get out of order. Either of these defects will involve the most serious consequences.

4. It must be economical to operate. An indicating instrument that requires for its operation any appreciable percentage of the current energy which it is designed to measure is a source of constant loss, and as the number of indicating instruments in a station frequently reaches scores, the advisability of installing instruments which are economical of energy requires no further pointing out.

Referring to the essential requirements of an indicating instrument as above suggested, let us see how they are fulfilled in the Weston instruments:

1. It must be theoretically correct in principle. The principle embodied in the Weston instruments consists in the simple movement of a small coil through a uniform magnetic field against the opposing force of a very light spring. By avoiding the use of all moving iron parts, magnetic lay is entirely eliminated.

2. It must be accurate throughout its entire range. By the very principle of its construction, involving a perfectly uniform magnetic field, the coil to which the pointer is attached in the Weston instruments, must take up a position corresponding exactly to the amount of current passing through it. It can do nothing else. It has no opportunity to go wrong.

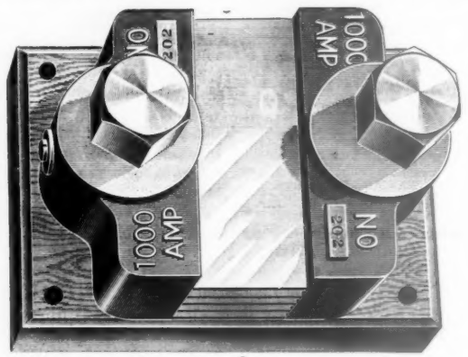

FIG. 2.—SPECIAL ALLOY SHUNT FOR WESTON STANDARD ILLUMINATED DIAL STATION AMMETER.

3. It must be simple in construction. The Weston instruments have but a single moving part, consisting of a little coil weighing a small fraction of an ounce, and to which the pointer traversing the scale is directly attached.

4. It must be economical to operate. Believing that an ounce of prevention is better than a pound of cure, Mr. Edward Weston has designed all his indicating instruments to operate with a very small amount of energy. In the station ammeter, for example, the loss is so small that twenty-five 1,000 ampere instruments would absorb about one horse-power. The loss of power in such an instrument, even if left constantly in circuit, is therefore quite insignificant. Over 120 voltmeters of the Weston type in a railway power station operating at 550 volts would absorb about a horse-power, while on 110 volts nearly 750 would take no more.

Besides the absence of magnetic lag already referred to, the correct electrical proportion of these instruments leaves them extremely free from heating errors, even where allowed to remain in circuit continuously.

Being based on the same principle as the celebrated Weston portable voltmeters, the station indicating instruments are likewise extremely "dead-beat," and their scales are absolutely proportional throughout their entire range.

The Weston illuminated dial station ammeter is based upon the same general principle as the regular Standard portable direct current ammeters, but is much larger, and the working parts are enclosed in a neatly designed cast iron case. This case is dust proof, to protect the working parts from mechanical injury. It also effectively shields the instrument from disturbing influences of external magnetic fields. These cases are finished in several styles.

FIG. 3.—WESTON CENTRAL STATION AND ISOLATED PLANT ASTATIC AMMETER 0 TO 50 AMPERES.

The instrument depends for its operation upon the fall of potential between two points of the circuit carrying the main current, and requires a difference of only about .03 volt to give the full scale deflection, at which time it is taking only .07 ampere, no matter what the total capacity of the instrument may be. The shunt required to secure the necessary fall of potential is not included in the case, but is separate from it, and is designed to be placed at the back of the switchboard. In most cases a special shunt can be dispensed with and a short section of the mains on the switchboard, or the mains leading from the dynamo can be used instead. In either case, only very thin wires are necessary to carry the extremely small current required to operate the instrument, No. 12 or No. 16 B. and S. gauge being sufficient in nearly all cases.

This feature of the instrument, in virtue of which it requires so little current to operate it, effects a considerable saving in copper in fitting the instrument to switchboards, etc., and this is especially the case with instruments of large capacity.

These instruments are practically free from friction error. They have also no "magnetic lag," and are consequently free from this serious source of error. They are very "dead-beat," and are extremely sensitive and accurate. Some idea of their sensibility may be formed from the fact that the turning on or off of a single lamp can be noticed by a careful observer on an instrument of 1,200 amperes capacity, and this at any point of the scale. This is equivalent to saying that a 5,000 ampere instrument will readily show a change of four amperes with any load within the rated capacity of the instrument.

It frequently happens that the capacity of a station is greatly enlarged and far beyond the range of the station indicating instruments already in place. Ordinarily this would necessitate the abandonment of such instruments and the purchase of larger ones, corresponding to the increased capacity. There would thus be involved a double expense, including, first, the loss of the value of the old instruments, and, secondly, the cost of the new ones. With the Weston illuminated dial ammeter, however, all this is avoided, for if, at any time, the station capacity should be increased, it would only be necessary to *recalibrate* the ammeter, since by its construction the instrument can be *adjusted to any range*. Yet another important consideration is the fact that the superintendent or manager of a station or power house can install one of these instruments in his office with practically no trouble, and thus have before him at every moment a reading of the station output, the reason being that only thin, light wires are necessary for the extra circuit.

The scales are made of opal glass set in a frame in the back of the instrument. At the back of the scale there is placed an incandescent lamp and a pair of mirrors properly disposed to illuminate effectively the scale uniformly from behind, thus making the figures, lines and pointer distinctly visible at a long distance from the instrument.

Two styles of shunts are made for use with these instruments. One style is made of copper, and is somewhat more accurate than the other, but is also much larger and more expensive. The other style consists of one or more sheets of a special alloy. Two sides of these sheets are fitted into grooves in two brass or copper blocks,

which are provided with large and small clamping screws, the former for connecting the shunts in circuit with the main conductor, and the smaller screws for connecting the thin wire leads to the instrument. The whole shunt is mounted on a wooden block to attach to the switchboard or other support for the mains. The copper shunts differ slightly in design from the alloy shunt, but not enough to require any special description.

If copper shunts are used, the instrument is practically independent of changes in temperature, remaining correct in its indications at all temperatures. Since the copper of the shunt has very nearly the same temperature co-efficient as the instrument, the ratio of the resistances of the two, therefore, remains the same. In using special alloy shunts, a small error is introduced by changes in temperature, since the temperature co-efficient of the shunt and of the instrument are not quite the same. The error may, however, easily be corrected; it amounts to one per cent. for a change of 10 degrees Fahrenheit above or below the temperature for which the instrument is calibrated. As the average temperature of a central station room is between 80 degrees and 100 degrees Fahrenheit, the instrument is calibrated for an average temperature of 90 degrees Fahrenheit, and is correct for that temperature.

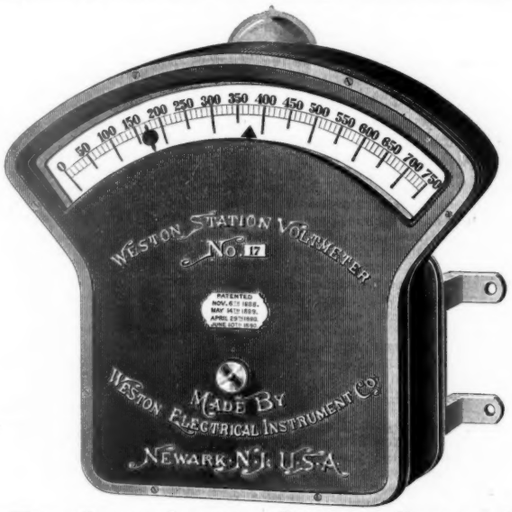

FIG. 4.—WESTON STANDARD ILLUMINATED DIAL STATION VOLTMETER, STYLE B.

The central station and isolated plant astatic ammeter is of the electro-magnet type, and has been expressly designed to meet the demand for a good, moderate priced, dead-beat ammeter, the indications of which may be relied upon, even under rapid and great fluctuations in the strength of the current, and which, at the same time, may be used in the presence of the most intense magnetic fields, without materially affecting the readings. These instruments are provided with a peculiarly shaped field, to utilize as perfectly as it is possible, the magnetizing effect of the current passing through the conductor, and so to secure the most intense field possible for a given length of conductor. There are thus obtained in spite of the influences acting against efficiency and accuracy in such types of instruments as ordinarily known, the conditions essential to economy of power in working, freedom from disturbance by external fields, and very small magnetic lag.

The instruments are metal cased throughout, and are so constructed as to render displacement of the operative parts in relation to each other impossible. They are dust-proof, well made, provided with sapphire bearings, and have hardened ground and polished steel pivots.

These instruments are so astatic that they may be used on the yokes or pole pieces of dynamos or motors, without materially affecting the readings. They are just as dead-beat as the regular portable standard instruments.

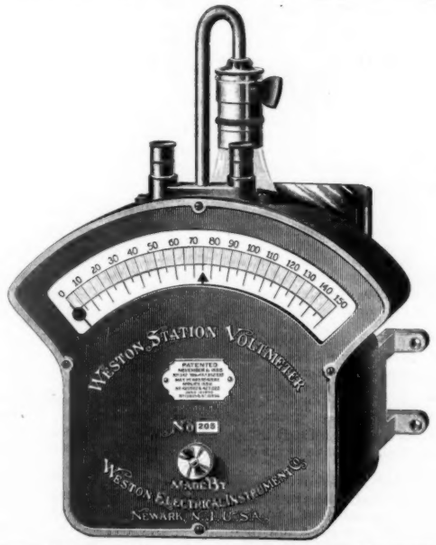

FIG. 5.—WESTON STANDARD ILLUMINATED DIAL STATION VOLTMETER, STYLE A.

Although the scales of these instruments, unlike those of the permanent magnet type, are not strictly proportional throughout their entire range, nevertheless the almost entire absence of magnetic lag renders their indications practically true for all points on the scale, either on increasing or decreasing currents.

The company makes two sizes of illuminated dial voltmeters, both of which are based upon the same principle as the portable standard direct current voltmeters, and embody all the latest improvements suggested by Mr. Weston's researches on these instruments down to the present moment. Like the illuminated dial ammeter, the voltmeters are enclosed in neatly designed dust-proof cast iron cases. They are provided with the same kind of scales and the same devices for illuminating the scales as are used with the ammeters, and are finished in the same styles. They have two indices. One of these is the indicating index, and has a fine point for close readings, with a blackened aluminum target disc, which, in conjunction with the other index termed the normal index, enables even a slight deviation from the normal voltage to be seen from a long distance. The normal index is inside the case and terminates in a triangular shaped piece of blackened aluminum. This arrow head index is adjusted from the outside of the case by hand, by means of the knurled knob seen on the front of the case. The index can be turned so that the upper angle of the triangle is at the point of normal voltage, and directly under the blackened aluminum disc of the indicating index. By this simple arrangement a very small change in the voltage can be seen at a long distance from the instrument.

These instruments are just as accurate, as sensitive, as well made and as well standardized as the best model portable standard direct current voltmeters. They are equally free from "magnetic lag," and are almost absolutely free from temperature error. No effort has been spared to make them durable, permanent and perfect. They are dead-beat, and we know that they are the very best and most reliable instruments ever made for the purpose intended. They are very high resistance instruments, and are consequently extraordinarily economical of power, while the coils are amply large enough to permit of the instruments being left in circuit continuously without material rise in temperature. They are pivoted and jeweled in just the same manner as the ammeters, and are sufficiently sensitive to show a change of one-twentieth of one per cent. in the voltage.

FIG. 6.—WESTON STANDARD ISOLATED PLANT VOLTMETER, HALF SIZE.

Quite a number of these instruments are in use in electric railway plants, where the fluctuations of electromotive force are very great, and a large number are in use in large incandescent light plants and lighting stations. They are giving perfect satisfaction and are spoken of in the highest terms by the users.

The Weston isolated plant voltmeters in their electrical and mechanical features are in every way the equal of the portable standard voltmeters and illuminated dial station voltmeters. The case is of cast iron, neatly finished, affording effectual protection against external magnetic influences. The scale of these instruments is drawn on stout opaque paper, and hence cannot be illuminated from the rear. This makes the construction of these instruments much cheaper. They are expressly designed for switchboard use in isolated plants and small stations. They are claimed to be more accurate and in every way better adapted for this class of work than any other instruments heretofore offered. They are also reasonable in price. They are finished in the same style as the illuminated dial voltmeters and ammeters already referred to.

Armour Institute.

With the University and Mr. P. D. Armour's latest gift, the Armour Institute, Chicago seems destined to become noted for scientific as well as commercial enterprise.

The building has been under construction for four years, and no one, except a few directly interested, knew of its purpose. The Institute is on the corner of 33d street and Armour avenue, and is pleasantly situated in the residence portion of the city. The building has four floors, with a basement and a power-house attached. It is built of brown stone and pressed brick, and the interior finished in white marble. The power plant is nearly completed, and consists of two Stirling water tube boilers and a 200 horse-power Hamilton-Corliss engine, which is to be run either condensing or non-condensing. Rope transmission will be used to connect the engine with the line of counter-shafting. Four dynamos will be attached to this line by friction clutches. The dynamos will be both alternating and direct. Two will be used for lighting, one for power, and the fourth for experimental purposes. All the machinery in the laboratories will be operated by motors. In the basement there are rooms for wood working, founding, forging and drafting, and several store and tool rooms. On the first floor there will be a mechanical laboratory and a machine shop, the office of the president and the general library. The second floor is devoted to the departments of electricity, chemistry and physics, each with ample laboratories and lecture rooms. There will be 14 more or less distinct departments, but the aim of the Institute is to become a technical school of the highest grade. The technical courses will be in mechanical and electrical engineering, physics and chemistry. A department of fine arts and architecture is contemplated. In addition, there is a school for librarians and a department of domestic science.

The faculty, as now organized, includes four professors, four directors of departments, four instructors, two assistants and an engineer. It is intended to equip each department with the best apparatus obtainable, so that unsurpassed facilities for instruction and investigation will be offered.

The appointment of the scientific faculty are, Victor C. Alderson, of Chicago, professor of mathematics; James C. Foye, of Lawrence University, professor of chemistry; Wilbur M. Stine, of the Ohio University, professor of electrical engineering; W. H. Runyon, of the Chicago University, instructor in physics; E. W. Cooke, of Chicago, director of school of mechanical engineering.

The library system of the Institute is expected to be of especial value. Each laboratory will be provided with a complete technical library, and in addition, there will be a general library of literary, historical and scientific works.

The Institute will open in September next. The school will be of the grade of the best technical schools in the country, but will offer more facilities in the way of practical training.

INCANDESCENT LAMP DISCUSSION.

(*Continued from page 97.*)

Mr. W. D. Weaver: The paper of Mr. Hering is one of unusual value, not only on account of the matter contained, but also from the important practical bearing of the subject.

The graphical method which Mr. Hering adopts is very interesting, and the curves enable one to easily follow and thoroughly understand the steps that lead to results that at first sight are rather startling. In this respect the graphical method is superior to an analytical one, but it has the misfortune in this case of being extremely laborious in application, and lacking in accuracy unless the curves are laid down on a large scale.

An inspection of Professor Thomas's table giving the variation of watts with the life of a lamp shows that the rate is remarkably uniform in the majority of the tests and numerically equal to an increment of .3 watts per candle-power per hundred hours. The regularity in these cases enables an analytical method of remarkable simplicity to be applied to the solution of the various problems considered graphically by Mr. Hering, the development of which is as follows:

Let T = total cost of one candle power of light for a given number of hours.

Let Y = average hourly cost during the same period.

Let a = cost of lamps per candle-power.

Let b = cost of one electrical horse-power per hour delivered at the lamp.

Let w = initial watts per candle-power.

Let k = increase of watts per candle-power for each hour of the life of the lamp.

Let x = hours that the lamp is used.

Assuming that the increase in watts per candle-power is by equal increments for equal increments of the time the lamp is burning, the watts being used at the time x are $w - k\,x$, and the total watts used up to the time x are

$$\int (w + k\,x)\,d\,x = w\,x + \frac{k\,x^2}{2}$$

The total cost, including the lamp cost, is, therefore,

$$T = a + \frac{b\,w\,x}{764} + \frac{b\,k\,x^2}{2 \times 746}$$

The average cost is

$$y = \frac{T}{x} = \frac{a}{x} + \frac{b\,w}{746} + \frac{b\,k\,x}{2 \times 746}$$

which is a minimum when

$$x = \sqrt{\frac{2\,a \times 746}{b\,k}}$$

If A is the cost of a 16 candle-power lamp and K the increase of watts per hour for a 16 candle lamp, the formula becomes

$$x = \sqrt{\frac{1492\,A}{b\,k}}$$

The value of k from Professor Thomas's experiments is .003 and consequently $K = .048$; substituting we have finally for the life, L, or the "smashing point,"

$$L = 176 \sqrt{\frac{A}{b}}$$

By substituting the corresponding values of a and b, the minimum values of the life measured from the final curves laid down in the graphical method are at once obtained from this formula, and it is remarkable that such a simple equation can replace a graphical method so unusually involved. The accuracy of the method of course depends upon the assumption in regard to the arithmetical increase of watts with the life of the lamp, but an inspection of Table I shows that in most cases an error in this respect is less likely to cause a serious error in the final result than the graphical method, unless the scale of the latter is large.

A singular deduction from the formula is that the "smashing point" does not vary with the watt efficiency of the lamp. Consideration, however, shows that the factors of the question of efficiency are merely the relation between the hourly lamp cost at a given time, and the increment of lamp energy at the same time, and as this is independent of the watt efficiency of the lamp, the latter does not enter.

As the most economical life varies directly as the square root of the cost of the lamp and inversely as the square root of the cost of the power, considerable variations in these values will not introduce large ones in the value of L, as the following table shows:

VALUES OF L.

	$b=$ 10 cents.	$b=$ 4 cents.
$A = 35$ cents.	333	510
$A = 45$ "	370	580
$A = 55$ "	404	650

The formula just deduced is based upon a constant value of K. Where this value varies materially, the following arithmetical method enables the "smashing point" to be determined, and also gives the ordinates of the curve showing the variation of the average cost of the unit light, the same that Mr. Hering constructs graphically.

In the tables below, which are based on lamps A and M of Professor Thomas's experiments, the hours the lamp has been used are in column A, and the watts at the end of each 100 hours in column B. The increase for each 100 hours is in column C, and the total increase at the end of a given period in column D. The cost of this increase at 15 cents per 1,000 watt hours is given in column E, and the average cost per 100 hours in column F, while column G gives the corresponding average cost of the lamp per candle-power per hundred hours, the cost of a 16 candle-power lamp being assumed 45 cents. Column H gives the gain per candle-power per hundred hours from the continued use of the lamp, and column I the loss, these quantities being the sums of the values in columns F and G, and corresponding to the ordinates of Mr. Hering's curve E.

Referring to the first table, it will be seen that at 300 hours the average cost of the increased watts required to maintain the unit length, is .8 cent per hundred hours, while an average of .04 cent is saved by continuing the use of the lamp; at the end of 400 hours, however, these quantities are 1.031 and .7 respectively, showing that the cost of the increased power has become greater than the saving from the continued use of the lamp. The exact time when the average increased power cost is equal to the average lamp cost is the "smashing point," and may be determined approximately by a proportion between the quantities for 300 and 400 hours.

The following formula enables the quantities in column D to be quickly calculated:

$$D = \left(n\,a + (n-1)\,b + (n-2)\,c + d + \right) - \frac{a + b + c + d +}{2},$$

where n = the hours in hundreds and a, b, c, d, etc., the values for 100, 200, 300, 400, etc., hours from column C.

LAMP A.

A	B	C	D	E	F	G	H	I	
0	3.9	0	0	0	0	0	....	.	
100	4.3	.4	.2	.2	.2	2.81	2.51	....	
200	4.6	.3	.75	1.125	.56	1.40	.84	...	
300	4.9	.3	1.5	2.40	0.80	.94	.14	....	
400	5.2	.3	2.75	4.125	1.03	.70	....	.33	
500	5.5	.3	4.2	6.30	1.26	.56	....	.70	
600	5.8	.3	5.95	8.925	1.48	.46	....	1.02	
700	6.1	.3	8.	12.	1.71	.40	....	1.31	
800	6.4	.3	10.35	15.52	1.94	.35	....	1.59	
900	6.7	.3	13.0	19.5	2.18	.31	....	1.87	
1000	6.8	.1	15.85	23.77	2.37	.28	....	2.09	
1100	7.0	.2	18.85	28.27	2.57	.25	....	2.32	
1200	7.1	.1	22.50	33.75	2.82	.23	....	2.59	

Minimum at 394 Hours.

LAMP M.

A	B	C	D	E	F	G	H	I	
0	4.8	0	0	0	0	...	....	....	
100	4.7	—.1	—.05	—.075	—.075	2.81	2.88	...	
200	4.7	.0	—.15	— 225	—.112	1.40	1.47	....	
300	4.8	.1	.05	.075	.025	.94	.97	....	
400	4.9	.1	.2	.3	.075	.70	.62	....	
500	5.1	.2	.5	.75	.15	.56	.41	....	
600	5.5	.4	1.1	1.65	.276	.46	.18	....	
700	5.8	.3	2.05	3.075	.44	.40	....	.04	
800	5.9	.1	3.1	4.65	.58	.35	....	.23	
900	6.1	.2	4.5	6.75	.75	.31	....	.44	
1000	6.1	.0	5.9	8.85	.88	.28	....	.60	

Minimum at 690 Hours.

Mr. Hering: The formula given by Mr. Weaver is certainly very interesting. I have not had an opportunity to examine it carefully, but if it is correct, which I do not doubt, it certainly is a valuable formula. But it seems to me that it is applicable only in a general way, that is, it might not show all the characteristics of the different lamps, because it is based on a uniform rate of variation in the efficiency of a lamp. It does not seem to be correct for the two ends of the curve, but that is, perhaps, of little importance, as it is correct in the neighborhood of the minimum point, and as long as its application is limited to that point only and not to any other parts of the curve. It seems to me that by using this formula the characteristics of the curves of different lamps, which are caused to a great extent by their different rates of increase of the watts per candle-power would be lost, or, in other words, curves constructed for different lamps would probably be parallel; but, as the important part is the minimum point, this objection may not be of much importance. I am very glad to see such a simple algebraic formula for determining this point, as it makes such deductions as these much more valuable. It should be remembered, however, that it is to be used only in the neighborhood of the minimum point. Before endorsing the formula, however, it would be well to see how closely the results for each of the different lamps agree with those in Fig. 3. The arithmetical calculations are not as tedious as might at first seem; a curve could probably be calculated in 10 or 15 minutes.

The method which I used for calculating the results is purely arithmetical and not graphical; it is merely the final result which is given graphically, because it shows much more than a column of figures would. Although Mr. Weaver's second method of calculation, shown in the tabulated matter, is interesting, it involves more calculations and more work than the simple arithmetical method which I used; besides, curves appeal to one much more than a column of figures do, particularly when two sets of similar figures are compared with each other. As there is no need of great accuracy in determining the best age, it is not unlikely that the purely arithmetical method used in the paper might, after all, be the simplest, especially when the data is not given in as convenient a form as in Prof. Thomas's paper.

Mr. George Hill: We should all feel grateful to Mr. Hering for again calling attention to this important subject, and those of us who have to look after clients' interests, predict probable results and the like, should appreciate these simple curves that will enable us to reach approximate results with considerable accuracy, while the formula that it called forth in the discussion will enable us to come still closer.

Apart from the perhaps insufficient data on which the conclusions were based, which were insufficient for very exact results or broad generalizations as to costs, but were ample for the underlying truths, the matter of interest should have been considered as one easily introduced, and, under certain conditions, materially affecting the result.

For example, take the case of a factory running the lamps for a few hours per day during nine months in the year, say the lamps cost $0.35, the power $0.04 per kilowatt hour, 16 candle-power lamps, and a life of 500 hours, current would cost $2.27, and interest $0.136, making the total $2.41; this is, of course, six per cent. per annum, which is too much to neglect. Or take an office building with some of the lights burning the same number of hours as those just noted, then with power costing $0.15 per kilowatt, we should have the total cost, including interest at six per cent., $8 for the 500 hour life, while in the same building there would be lamps burning nine hours every day, and, as a consequence, being renewed every 55 days for a 500 hour life, the cost of which, taking interest into account, would be for the first, $7.62; for the fifth, at the end of the year, say, $7.90, and for the eleventh, or the second year, $8.35; a gain at the end of two years of $0.73, or 9½ per cent. The investigation could be carried along this line much farther with interest, but it is not the line from which the best results can be obtained.

No one who has kept posted has been willing to deny that there was an economical limit or "smashing point" in the life of the lamp, and many have thought that it was about 400 to 600 hours; in fact, two years ago I wrote a specification for a plant that we were installing calling for an initial efficiency of three watts per candle and a life of 600 hours, which was hardly commercially possible then, although one manufacturer thought that he could comply with the conditions. This was done simply as the result of something that I heard or read, and does not deserve any particular credit.

The point that is most desirable of solution in my mind is, How can we take advantage of this knowledge in a practical way in the operation of our plants? How can the manager of the small central station replace the lamps that are not doing their full duty or are taking too much current? In my own house I have some lamps that have been unchanged for nearly five years, burning an average of two hours per day for 270 days in the year, which would be a life of 2,700 hours. They have been satisfactory, as they are all hall lights, and not easily reached, and have never been changed.

There should be, first, a new curve plotted or a new formula deduced, with the element of the wages of a lamp collector added, so as to get a new economical life; and then, second, some form of apparatus devised that would make it easy to determine the efficiency of each lamp. Possibly the candle-power test spoken of by Mr. Hering, if applied as a photometric test by the station management, would be the simplest, but if we wait until there are complaints about the light, we shall certainly run the lamps far beyond the economic point. Under such conditions we could call for a testing apparatus in each installation and instruct those who were to run it in its use, so as to do the best that present knowledge permits of for our clients.

Professor Thomas's conclusion from Mr. Hering's paper is that the development of the future will be in the line of the central station furnishing so many watts of energy to the consumer to do as he pleases with; and he may be right for central station cases, although I am disposed to think that it would be found to be economy to exercise an oversight in these matters, the station taking away the lamps every few months, replacing them with new ones, testing those taken away, rating them and using them on circuits of known duty, and instead of charging for the renewing, lumping it in the charge for current. For the isolated plant, especially in large office buildings, the owner, as a matter of course, supplies the tenant with light, and there he must look after the lamps himself or waste much energy, since he is only required to supply a certain amount of light, and if the lamps are dull, there will be more turned on, until finally all the lamps are in use, and then when they are insufficient there will be a complaint, and an increase in the output of current of about 10 per cent. Keeping in mind, then, the lesson of the paper, it will be seen how necessary it is to have some way of watching the lamps that is quickly applied; then the engineer of the building would each month change all of the lamps, test them, put those that are nearly used up in the halls and new ones in the offices, so keeping them always under supervision, and smashing them when the proper time comes.

Mr. Townsend Wolcott: Mr. Howell read a paper before the Institute April 10, 1888, in which it was assumed that the watts per candle-power for a given lamp were constant during its life. Yet, notwithstanding this assumption, it was pointed out in the discussion that a lamp could live too long, its efficiency being impaired by blackening. Mr. Howell stated that the relation between cost of power and first cost determined the most economical life of lamps—that is, the greater the cost of power in relation to the first cost, the hotter we can afford to burn the lamps. The cost of lamp manufacture (or at all events, the selling price of lamps) has been reduced since that time, while that of power has not, and it ought to pay to burn them hotter, and I should be glad to see that done. I do not consider that a bottled angle worm is a suitable light. The incandescent lamp lacks just a little of being a beautiful light. Just when every one begins to admire the light we find that we are away above the voltage marked on the lamp. In some places where lamps are run from existing power, or where the cost of power is not considered, they think more of the cost of lamps than anything else. In one place I have in mind 112 volt lamps are run from a dynamo which does not give above 110 volts. Where a good light is required the tendency is to use them up quicker. Although Mr. Hering's paper starts from a very different basis from Mr. Howell's, it leads to the same conclusion, so far as the most important point is considered, namely, that we can afford to have better light than we have been getting.

Mr. Hammer: The paper referred to was read while I was out of the country, and having had occasion to look into the matter recently, I was much interested in the published tests. Some of the tables have a direct bearing upon Mr. Hering's conclusions. One curve shown by Mr. Howell was stated to have cost $10,000, and the tests covered an enormous period of time. In laying down a law and forming conclusions such as shown in Mr. Hering's paper, it seems to me they should be based on various types and upon a large number of lamps tested under the same conditions.

The Chairman: There is much food for thought in Mr. Hering's paper, and its ideas, as elucidated by him and by the members who have favored us by discussion, are clearly of such practical importance that they merit the mature consideration of all who are interested in illumination by glow lamps, whether producers or consumers.

While the idea of cutting short the life of an incandescent lamp is an absolutely new one to me, I have thought, while listening to the discussions, that it is one capable of much wider application than the paper suggests. For example, to human beings who have outlived their usefulness and whose life is devoted to making the lives of their fellow-creatures miserable.

My early years were embittered by an aged and crabbed male relative, and I think now, if I had had then the suggestions contained in Mr. Hering's paper, I might have taken into consideration the circumstance that it was a waste of energy to keep him going, and that in the interests of law and order—seeing that he had reached that period which Mr. O'Keenan, impelled by the hereditary instincts of his race, calls the "smashing point"—it was my duty to disconnect him.

Personal Magnetism.

Jeweler—Your watch is magnetized. Have you been near a dynamo or riding on the electric cars recently?

Jim Hickey—No; but I've been—er—calling a good deal on a very attractive young lady.—*Puck.*

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

PHILADELPHIA, PA.—Edward D. Morrell is at the head of a company who has applied for a charter to build an electric railway from Philadelphia to Trenton, N. J.

LONG BRANCH, N. J.—The Third Avenue Railroad Company; capital $100,000. Incorporators, Edward Hughes, Harry W. Green, Howard Green, and C. Asa Francis. A petition for a franchise has been filed with the City Clerk.

NEEDHAM, MASS.—The selectmen have granted a franchise to the Needham & Newton Electric Street Railroad Company.

POUGHKEEPSIE, N. Y.—The New Paltz & Highland Electric Railroad Company has been incorporated with a capital of $90,000 by Wm. H. Price, James Hayden, Solomon Deyo and Geo. A. Johnson, of New Paltz, and Chas. W. H. Arnold, of Poughkeepsie. The company will build and operate a street surface railroad for a distance of nine miles in Ulster County.

NORWICH, CONN.—The Norwich Street Railway Company announces that the road will be extended to Yantic contemporaneously with the granting of the charter by the legislature.

NORWALK, O.—Prominent business men of Norwalk have forwarded articles of incorporation to Columbus for building the Norwalk and North Fairfield Electric Railroad. John A. Williamson, Harry H. Hoyt, T. F. Hildreth, C. P. Wickham, and Frank H. Evans are named as incorporators.

BALTIMORE, MD.—The Baltimore Traction Company has purchased the Baltimore and Curtis Bay Electric Railway.

NAPOLEON, O.—A company has been formed for the purpose of building an electric railway from Bryan to Ridgeville, Napoleon, Grand Rapids, Green Springs, Tiffin, Fostoria and Findlay.

TERRE HAUTE, IND.—An Eastern syndicate has purchased the street railway system here, and will make improvements and extend the lines.

KALAMAZOO, MICH.—The General Electrical Company is endeavoring to secure the right of way from Kalamazoo to Gulf Lake. If successful, an electric railroad will be constructed.

CAMDEN, N. J.—The Electric Transit Company; capital, $100,000. Incorporators, John W. Hayes, of New Brunswick; James A. Wright, and Thomas Bailie, of Philadelpha; and S. Thayer, of Clementon, and Chas. S. King, of Camden. The object of the corporation is to purchase and sell electrical appliances for railroads.

RAMAPO, N. Y.—The Rockland Electric Company; capital, $25,000. Directors, H. C. Wanamaker, J. I. Traphagen, R. G. Riggs, C. B. Church, and James B. Suffern.

PALMYRA, N. Y.—The Board of Trustees of Palmyra have granted an electric light franchise to C. C. M. Hunt and B. H. Davis.

PERRY, N. Y.—The Perry Electric Light Company has become incorporated, and elected Milo H. Olin, president; Henry N. Page, vice-president; Clarence M. Smith, secretary; and Wm. D. Page, treasurer. The company has a capital of $25,000, and has purchased the plant of the Perry Electric Light and Power Company, and assumed all obligations.

PHILADELPHIA, PA.—The Electric Traction Company has bought a large tract of land on which a new power station will be built.

SCRANTON, PA.—The Scranton and Abington Street Railway Company has been incorporated with a capital stock of $100,000 by Chas. Dupont Brick, Jno. A. Means, E. C. Dimmick, Jno. Burd and H. N. Patrick. Length of the road, nine miles.

KENTON, O.—Daniel Flanagan, editor of the *Democrat*, has been granted a franchise for the construction of an electric street railway. The road will be pushed rapidly to completion.

BRIDGEPORT, CONN.—The Bridgeport Horse Railroad Company has been sold to Colonel Heft and his associates. Colonel Heft recently purchased the East End Railway, and now both systems are under one control.

PASSAIC, N. J.—Articles of incorporation have been filed at Trenton and a charter granted for an electric railroad, to run from Passaic to Bloomfield, Montclair, Verona and Caldwell, a distance of about 10 miles. The incorporators are Moses E. Worthen, John Kennell and Geo. B. Waterbose, of Passaic; Wm. P. Aldrich and Lester E. Wood, of New York. The company is capitalized at $200,000.

BUFFALO, N. Y.—The Buffalo and Niagara Falls Electric Transit Land Company, of Buffalo; capital, $63,500. Directors, E. A. Kibbee, of Mayville; Myron B. Dunham, of Warren, Pa.; D. D. Dorn, of Jamestown; Arthur A. Johnson, of Buffalo, and others.

NIAGARA FALLS, N. Y.—The Buffalo and Niagara Falls Electric Railway Company; capital, $1,000,000. Incorporators, W. Caryle Ely, of Niagara Falls; Frederick Swift and Wendall Goodwin, of New York city; George H. Wirth, of Brooklyn, and Joseph A. Powers, of Lansingburgh. The road will run for 5¼ miles, commencing at Niagara Falls and terminating in Tonawanda.

THOMASVILLE, GA.—The electric railway company and the electric light company will consolidate and put in a $50,000 plant.

DAYTON, O.—The Dayton Traction Company; capital, $200,000. Incorporators, William Huffmann, Stephen J. Patterson, William A. Mays, Dennis Dwyer and Walter W. Smith.

CLEVELAND, O.—The East Cleveland, Broadway and Newburgh and other street railroad companies of Cleveland have consolidated under the name of the Cleveland Electric Railway Company, with a capital stock of $6,500,000. The incorporators are Henry A. Everett, Charles W. Wason, H. A. Bradley, Horace E. and Samuel Andrews, Edwin Fowler and Charles J. Seabrook.

MARION, IND.—The Marion City Railway Company; capital, $500,000. Incorporators, J. T. Sweetser, W. H. Carroll, Philip Malter and G. G. Wharton.

GREENWICH, N. Y.—A certificate of consolidation of the Greenwich Electric Light and Power Company and the Cambridge Electric Light and Power Company, forming the Consolidated Electric Company, of Greenwich, has been filed with the secretary of state. The capital stock is $35,000.

Electric Light and Power.

CHICAGO, ILL.—The Consolidated Electric Company; capital, $50,000. Incorporators, Louis B. Scott, C. Oakamp and Chas. P. Emmons.

PAXTON, ILL.—The Paxton Electric Company has increased its capital stock from $24,000 to $40,000.

CHICAGO, ILL.—The Sterling Motor Company; capital, $60,000. Incorporators, Sidney C. Eastman, Harry E. Pratt and B. N. Schumacher. The company will manufacture and deal in all kinds of electrical apparatus and machinery.

CHICAGO, ILL.—The Queen Electric Company; capital, $15,000. Incorporators, David A. Bennett, Henry G. Hinkle and John F. Schaeffer.

COLCHESTER, ILL.—The Colchester Electric Light and Power Company has filed articles increasing its capital stock from $6,000 to $12,000.

STOCKTON, CAL.—Articles of incorporation of the Stockton Power Transmission Company, capital, $1,000,000, have been filed by San Francisco and Stockton capitalists. The company will generate electricity with water power on the Mokelume river, 42 miles from this city.

NIAGARA FALLS, N. Y.—The Power City Illuminating Company has been granted a franchise with privileges to run wires and erect poles for their electric lighting system.

HOLLAND, MICH.—The common council will submit to the people at the coming election the question of whether or not the city shall issue bonds for an electric light plant, to cost from $12,000 to $15,000.

PARIS, TENN.—The election by the voters of this city on the question of electric lights resulted in favor of the proposition.

MERIDIAN, MISS.—H. C. & F. E. Gallagher and I. N. Schulherr have applied for a charter for the Edison Electric Light and Power Company; capital, $50,000.

LEADVILLE, COLO.—The Colorado Water and Power Company, a new organization, will establish a new electric light system in Leadville, and will have the plant in operation by September 1, if the city councils grants a franchise at once.

JACKSON, MICH.—The Jackson Light and Power Company; capital, $100,000. Incorporators, W. A. Foote, A. N. Foote, J. B. Foote and I. W. Foote. The company will furnish electric light, power and heat.

DE PERE, WIS.—The De Pere Electric Light and Power Company; capital, $20,000. Incorporators, John Dousman, Wm. Armstrong, C. G. Wilcox and J. B. Chase.

New Manufacturing Companies.

CHICAGO, ILL.—The Sloss Electric Gas Light and Specialty Company; capital, $50,000. Incorporators, Aaron M. Sloss, Louis Stein and Sydney Stein. The company will manufacture and sell electric gas lighters and electrical appliances.

CHICAGO, ILL.—The National Electric Lamp Lighter Company; capital, $50,000. Incorporators, W. Irving Culver, Josephine C. Chambers and P. E. Stanley.

DAVENPORT, IA.—The Tri-City Electric Street Sprinkler Company; capital, $100,000. Incorporators, E. H. Guye and W. T. Quayle, of Rock Island; W. R. Moore, of Moline, and T. A. Murphy, of Davenport. The company proposes to introduce a sprinkler system to be operated from a tank car, operated with electric motors.

New Telegraph Company.

ALBANY, N. Y.—The Municipal Telegraph Company, capital, $100,000, has been incorporated by John Mack, James L. Holland, John Graham and Patrick H. Mack, of Albany, and John S Campbell, of New York city. The general route of the line will be from Albany to New York, and will there connect with other cities. The majority of the incorporators are interested in Albany pool-rooms.

ELECTRIC RAILWAY AND POWER NOTES.

The trolley is the real estate man's best friend.

Monongahela City citizens look for an electric railway from Pittsburgh to that town at no distant date.

The Atlantic City, N. J., beach front owners are protesting against the proposed electric road along the beach, and have employed Samuel E. Perry to look after their interests.

The work on the Cayadutta, New York, electric road is progressing finely. Track has now been laid from Hill street in Gloversville, to within one and one-half miles of Fonda, excepting a couple of connections that will require about 600 feet of track laying.

J. K. Tillotson's electric railway, known as the Put-in-Bay Southern, of Toledo, O., is to be extended to Lakeside. It is stated that Mr. Tillotson has placed $600,000 of the railway bonds with the General Electric Company, of Boston. Work will be commenced upon the new road at once.

The Westinghouse Electric Company, on Tuesday last, closed a contract with the Atlantic Avenue Passenger Railway Company, of Brooklyn, N. Y., to equip the latter company's road with Westinghouse electric generators and motors. The contract calls for 400 motors, or nearly as many as contracted for by the Philadelphia Traction Company, and is worth close to $1,000,000.

The contemplated electric railroad from Spokane to Cœur d'Alene City has not been abandoned, as was thought, but it will be built during the coming summer and fall. The line of the road, it is stated, will deviate but little from the survey made by Mr. Riblet last summer. This survey crosses the Spokane river near the Idaho line, about one mile above the Cowley bridge and six miles above the new Barker bridge.

The stockholders of the Woonsocket Electric Machine and Power Company, at their annual meeting last week, voted to increase the capital of the company from $250,000 to $400,000. It was also voted to purchase the plant of the Franklin (Mass.) Electric Lighting Company. The directors have voted to purchase several unoccupied mills, formerly used by the Harris Woolen Company, and will establish a power station there.

It may not be a long time before the two cities of Buffalo and Niagara Falls are connected by an electric railroad. Some of the component parts of this line are already completed, and last week the Buffalo and Niagara Falls Electric Railway Company was incorporated with a capital of $1,000,000. This railroad will be five and a quarter miles long, beginning at the east line of the city of Niagara Falls and terminating at the point where Oliver street, in the village of Tonawanda, intersects the northwesterly village line.

President Dodd, of the North Hudson Railroad, has given orders for the removal of the immense machinery used for years by the elevated at Palisade station, which has been pronounced by engineers as among the most magnificent engines ever made. The famous cable, which carried cars in eight minutes from the top of the Palisade to the Hudson is rotting on the track, covered with rust, and the strands are breaking. The electric cars now make the run in three and a half minutes. The cable will also be removed by order of the president.

A. M. Billings, the principal owner of the Citizens' Street Railway Company, of Memphis, Tenn., which operates all of the electric lines in Memphis, with one exception, is preparing to sell his property to a New York syndicate, of which Jacob Seligman, the banker, is the head. The amount offered Mr. Billings for his interest is $1,500,000, and it is understood that he will accept the proposition. The Seligman syndicate recently purchased the St. Charles Street Electric Railway, of New Orleans, and it is said that a quiet move is on foot to obtain also the street railway systems of Memphis, Nashville, Chattanooga, Birmingham, Montgomery, Mobile and Atlanta.

KINDRED INTERESTS

The Tuerk Water Meter Company, of Fulton, N. Y., have sent out an interesting little catalogue describing their ventilating fans, which may be operated either by electric or water motors.

The Falls Rivet and Machine Company, Cuyahoga Falls, O., are replacing the shafting and friction clutches in the burned portion of the Buffalo General Electric Company's Elk street station, which was recently damaged by fire.

We Wish to Call Attention to the fine exhibit of Lundell motors at the store of the Central Electric Company, Chicago, consisting of a complete plant of motor driving a generator, which, in turn, generates current to operate lamps, fan motors, or the new Lundell exhaust outfit. High efficiency is shown in this combination, and it is well worth one's time for examination.

The Ball Engine Company, Erie, Pa., are to furnish four 150 horse-power engines for the electric plant of the MacKaye Spectatorium, of the Columbian Celebration Company, which is to be one of the most unique and interesting features of the Columbian Exposition, and which will be to the Columbian Exposition what the Eiffel Tower was to the Paris Exposition in 1889.

F. E. Reed & Company, Worcester, Mass., manufacturers of machinists' tools, have one of the most extensive plants in that busy manufacturing center. The shops occupy three large buildings, giving a floor space of about 1¼ acres. The business was established by Mr. Reed in 1875. The shops are lighted from a private isolated electric light plant, the first established in the city of Worcester.

Very Nearly 2,250,000 pounds of steel will be used in the roof of the MacKaye Spectatorium, which is now being built at Jackson Park, off the lake shore, in Chicago It was a matter of considerable study with the contractors how to place this mass of steel in position, there being no derrick large enough or strong enough to do the work at the altitude required. At length, however, an enormous traveling derrick has been secured. This derrick is of sufficient altitude to work to advantage at a height of 180 feet, which is the highest point on the roof, and strong enough for the purpose required. It is the largest ever built and weighs, with its cables and tackle blocks, a little over 154,000 pounds.

The Brush and Short Companies Elect Officers.

The Brush Electric Company, of Cleveland, Ohio, elected the following officers at the annual meeting of the company, held Tuesday, March 21, 1893: W. H. Lawrence, president; John S. Bartlett, first vice-president; C. A. Coffin, second vice-president; S. M. Hamill, secretary; W. B. Bolton, general counsel; B. F. Miles, treasurer; S. M. Hamill, general manager; A. H. Hough, assistant treasurer; L. B. LeVake, assistant secretary; J. F. Hughes, auditor.

The annual meeting of the stockholders of the Short Electric Railway Company, of Cleveland, was held on March 22. The following directors were elected: S. H. Short, W. H. Lawrence, M. T. Herrick, W. B. Bolton, B. F. Miles, James Parmelee, and S. M. Hamill. Immediately after the stockholders' meeting, the directors met and elected the following officers: B. F. Miles, president; S. H. Short, vice-president; W. B. Bolton, general counsel; S. M. Hamill, general manager. The following executive committee was elected: W. H. Lawrence, B. F. Miles, S. M. Hamill. The usual reports were presented to the stockholders.

The Westinghouse Lamp.

We are informed that the Westinghouse Electric and Manufacturing Company is shipping stopper lamps to the World's Fair and to other customers. The new factory is running day and night, and shipments this week have been at the rate of 5,000 lamps a day. Within 60 days it is expected that this output will be more than doubled.

LITERARY.

"Transactions of the American Institute of Electrical Engineers, for March, 1893," has been received.

Scribner's Magazine for April opens artistically with a rich group of illustrations by Robert Blum, who has recently returned from a two years' residence in Japan.

The first edition of the *Buyer's Reference* has been issued. It is devoted to the electrical and allied industries, and is expected to be issued quarterly. There are three parts, the light and power edition, supply and construction edition, and the street railway edition, all of which are typographically good.

Mr. Frederick W. Hamilton, of Pawtucket, R. I., has been awarded the first prize of $150 in *Public Opinion's* (Washington, D. C.), Essay Contest, just closed. The subject on which prizes were offered was, "What, if any, changes in the existing immigration laws are expedient?" There were nearly 200 essays submitted in competition. The second prize of $100 was taken by Mr. W. E. Weyl, of Philadelphia, and the third prize of $50 went to Mr. Loren H. Knox, of Evanston, Ill. These prize contests on the great questions of the day, inaugurated by *Public Opinion*, have attracted marked attention.

The "Progress of the World"—summing up the recent movements, political and otherwise, of the past month—is particularly strong and full in the April number of the *Review of Reviews*. This editorial department is universally regarded as one of the best features of the most remarkable magazine of the day. The American editor discusses the full restoration of the Democratic party, the Hawaiian question, and a variety of other issues, while Mr. Stead contributes a most brilliant and graphic discussion of the English political situation, and the merits and demerits of the Gladstone Home Rule bill. The department of Current History in Caricature also may, perhaps, be called stronger than usual this month, although it is always full of variety and surprises. It covers a wide range, quoting from Italian, French, German, Australian, Canadian and English, as well as from American caricaturists.

"The Voltaic Cell." By Park Benjamin. John Wiley & Sons, New York. An exhaustive treatise on the subject of chemical generators of electricity. Besides containing a description of the innumerable types of primary and secondary batteries, which make up the history of the art, it gives detailed accounts of the more important types. The work is liberally illustrated, and contains reports of the most recent researches as to efficiency. The first part of the treatise is devoted to a historical sketch of the art and a full discussion of the various modes of electric measurement as applied to batteries; then in order are considered single fluid cells, two fluid cells, heat cells, a very interesting type, light cells, dry cells, special types of cells, gas cells and secondary batteries. The electro motive force of the enormous number of cells considered is given with a full consideration of the reactions of the better known types. The last chapter contains a description of the many curious ways in which generation of electricity has been noticed; such as by pressure, vibrations, molecular strain, cleavage, capillary action, filtration, contact of metals, congelation, solution, evaporation, flame, vegetable and animal functions, etc. It is claimed this is the most exhaustive treatment of this subject yet produced. It contains upwards of 500 pages full of matter valuable to those engaged in investigations of this type of electrical generator. The work will be found of great value to those desiring full data on the subject of batteries, and which could not be obtained elsewhere except by a painstaking search through the general literature of the art. It is especially valuable as a book of reference to the connoisseur.

"The Measurement of Electrical Currents and Other Advanced Primers of Electricity." By Edwin J. Houston, A. M. New York: The W. J. Johnston Company, Limited, 41 Park Row, 1893; 429 pages, 169 illustrations. Price, $1. Supplied by the ELECTRICAL REVIEW, 13 Park Row, New York. "Electrical Measurements and Other Advanced Primers of Electricity" is the second volume of Professor Houston's series of elementary electrical treatises for students and non-technical readers. A third volume will complete the series, but there is no necessary connection between the several volumes, each one being complete in itself, as are the several primers in each volume, as far as possible. The book derives its title from the first three primers, which are the measurements of electric currents, electromotive forces and resistances, respectively. The object of these primers is not so much to teach the practical operations of electrical measurements, as to explain in simple but exact terms the principles and apparatus upon which they are based. Two primers are on voltaic and thermo-electric cells and other sources of electricity. The principles upon which commercial currents are based are explained in three primers, and nine others are devoted to the principles and applications of dynamos, motors and transformers, the eighteenth and last primer being a review, or primer of primers. The 200 and odd pages on electric lighting and power deal very thoroughly with the different methods and apparatus in practical use. This section will be particularly welcomed by the large class of intelligent readers who desire to obtain a correct knowledge of the applications of electricity, and will also, from the author's careful exposition of principles, be of marked value to electricians and students.

TELEPHONE CHAT.

It is said that the German Telephonic Department intends to connect Berlin and London by telephone.

It is understood that the Central Telephone Company has under consideration the project of extending its line from Ebensburg to Spangler, Hastings and Patton, Pa.

A new telephone company, in which officers of the Thomson-Houston Electric Company are said to be interested, will pay five per cent. of its gross receipts to the city of Philadelphia in exchange for a charter.

An exceedingly delicate and quick-reading electrical thermometer has recently been brought out in France. It is intended for clinical work and will record variations in temperature of one-twentieth of a degree centigrade.

Last week 10,300 feet of cable was ordered for the telephone connection between Coaster's Harbor Island and Potter's Cove, Conanicut. The Providence Telephone Company has petitioned Captain Bunce for permission to cross Coaster's Harbor Island, and the above gentleman has referred the same to the authorities at Washington. When established this part of the Providence Telephone Company's system will have cost fully $5,000.

The American Telephone and Telegraph Company has brought an action against the Consolidated Street Railway Company, of Syracuse, N. Y., to recover $4,000 for damages to its test house at Onondaga Valley, which was destroyed by fire June 4 last. The plaintiff at that date was erecting a number of poles on which to connect the wires used in operating its present system. It is alleged that the defendant attached its wires to the poles owned by the plaintiff, and that on the day in question, when the defendant turned on the current of electricity needed to operate its cars, the current traversed the wires owned by the plaintiff, igniting a block of wood in the power house, which was destroyed before the blaze could be extinguished. The house was valued at $2,500 and the apparatus at $1,500.

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2,000 Candle Power, Second Hand.

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A position as superintendent of central station or electrical engineer of railway plant, by a man of six years' experience in installing and operating lighting and power plants of several standard systems. Good references given. A. O., Care

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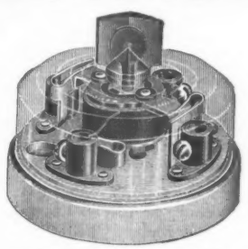

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